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# Stormwater Impact Analysis

The Point / 2021110396 / February 2022



# THE POINT

## PACKAGE 2

*ROLESVILLE, NORTH CAROLINA*

## STORMWATER IMPACT ANALYSIS AND FINAL DESIGN OF SCMS

CONSTRUCTION DRAWINGS  
*PLANNING #: SUP 18-09*

PROJECT NUMBER: 2021110396  
DESIGNED BY: DANIEL WIEBKE, PE, CFM  
TOMMY DABOLT

DATE: FEBRUARY 2022



McADAMS  
2905 MERIDIAN PARKWAY  
DURHAM, NORTH CAROLINA 27713  
NC LIC. # C-0293

## THE POINT

### Stormwater Impact Analysis-CD Package 2

#### GENERAL DESCRIPTION

The Point is a proposed residential development in Rolesville, North Carolina, located between Highway 401 and East Young Street/Rolesville Road. The development is approximately 300 acres, divided into a northern parcel (to be developed at a later date) and a southern parcel. This Stormwater Impact Analysis covers the development of the southern parcel only. The development will consist of approximately 804 lots, a mixture of townhomes and various types of single-family housing, thirteen stormwater control measures, sidewalks, roadways, greenway trail, and associated infrastructure. At this time stormwater control measures have been developed to a construction level for a portion of the site referred to as CD Package 2. This package includes 5 stormwater control measures; SCM B, G, H, I and J. Preliminary SCMs associated with package 1 are included in the modeling shown in this report, to reflect CD Package 1 being fully constructed prior to the construction of CD Package 2.

The project site is located in the Neuse River Basin, and drains to Harris Creek (Peeples Creek / Wake Crossroads Lake) (BIMS # 27-26) and is classified as C;NSW. Per Town of Rolesville regulations, stormwater management on this site shall meet the stormwater management performance standards for development set forth in the Rolesville Unified Development Ordinance Article 7, Section 7.5.4 – Standards.

The regulations are as follows:

#### (B) Standards Based on Project Density

**(4) Development Standards for High-Density Projects** High-Density Projects shall implement stormwater control measures that comply with each of the following standards, in addition to the General Standards found in subsection B of this Section:

- (a) The measures shall control and treat runoff from the first inch of rain. Runoff volume drawdown time shall be a minimum of 48 hours, but not more than 120 hours.
- (b) All structural stormwater treatment systems used to meet these requirements shall be designed to have a minimum of 85 percent average annual removal for Total Suspended Solids (TSS).
- (c) All Development and Redevelopment projects required to manage storm water shall provide permanent on-site BMPs to lower the nitrogen export amounts as part of the storm water management plan. BMPs are to be in accordance with and as specified in the Design Manual.
- (d) Structural and Non-structural BMPs shall be used to ensure there is no net increase in peak flow leaving the site from the pre-Development conditions for the one-year, 24-hour storm. Runoff volume drawdown time shall be a minimum of 48 hours, but not more than 120 hours.
- (e) General engineering design criteria for all projects shall be in accordance with 15A NCAC 2H .1008(c), as explained in the Design Manual;
- (f) All Development and Redevelopment shall be located outside the Riparian Buffer Zone and the Flood Protection Zone. These Zones shall be in accordance with the following provisions:
  - i. Except where other applicable buffer standards are more restrictive, the Riparian Buffer Zone shall extend a minimum of 50 feet landward of all Perennial and Intermittent Surface Waters. The most restrictive standards shall apply.
  - ii. The Riparian Buffer Zone shall remain undisturbed unless otherwise permitted by this section.
  - iii. The Flood Protection Zone shall extend throughout the FEMA 100-year floodplain as identified on the current Flood Insurance Rate Map (FIRM) published by FEMA. The Flood Protection Zone shall remain undisturbed unless otherwise permitted by this section.

- iv. No Development or Redevelopment is permitted within the Riparian Buffer Zone or the Flood Protection Zone except for stream bank or shoreline restoration or stabilization, water dependent structures, and public or private projects such as road crossings and installations, utility crossings and installations, and greenways, where no practical alternatives exist.
  - v. Permitted activities within the Riparian Buffer Zone and the Flood Protection Zone shall minimize impervious coverage, direct runoff away from surface waters to achieve diffuse flow, and maximize the utilization of Non-structural BMPs.
  - vi. Where the Riparian Buffer Zone and the Flood Protection Zone both are present adjacent to surface waters, the more restrictive shall apply.
- (g) The approval of the stormwater permit shall require an enforceable restriction on property usage that runs with the land, such as recorded deed restrictions or protective covenants, to ensure that future Development and Redevelopment maintains the site consistent with the approved project plans. Buffer widths and locations shall be clearly delineated on all plans, final plat, and as-builts.

## (B) General Standards

**(1) Downstream Impact Analysis** The downstream impact analysis must be performed in accordance with the "ten percent rule," and a copy of the analysis must be provided with the permit application. The purpose of the downstream impact analysis is to determine if the project will cause any impacts on flooding or channel degradation downstream of the project site. The analysis must include the assumptions, results and supporting calculations to show safe passage of post-Development design flows downstream. This analysis shall be performed at the outlet(s) of the site, and downstream at each tributary junction to the point(s) in the conveyance system where the area of the portion of the site draining into the system is less than or equal to ten percent of the total drainage area above that point.

**(2) Standards for Stormwater Control Measures**

**(a) Evaluation According to Contents of Design Manual** All stormwater control measures and stormwater treatment practices (or BMPs) required under this ordinance shall be evaluated by the Stormwater Administrator according to the policies, criteria, and information, including technical specifications and standards and the specific design criteria for each stormwater practice, in the Design Manual. The Stormwater Administrator shall determine whether proposed BMPs will be adequate to meet the requirements of this ordinance.

**(b) Determination of Adequacy; Presumptions and Alternatives** Stormwater treatment practices that are designed, constructed, and maintained in accordance with the criteria and specifications in the Design Manual will be presumed to meet the minimum water quality and quantity performance standards of this ordinance. Whenever an applicant proposes to utilize a practice or practices not designed and constructed in accordance with the criteria and specifications in the Design Manual, the applicant shall have the burden of demonstrating that the practice(s) will satisfy the minimum water quality and quantity performance standards of this ordinance. The Stormwater Administrator may require the applicant to provide the documentation, calculations, and examples necessary for the Stormwater Administrator to determine whether such an affirmative showing is made.

**(c) Separation from Seasonal High Water Table** For BMPs that require a separation from the seasonal high-water table, the separation shall be provided by at least 12 inches of naturally occurring soil above the seasonal high-water table.

## CALCULATION METHODOLOGY

- Areas outside of the Package 1 and Package 2 area have been assumed to be undeveloped for the purposes of this analysis.

- Rainfall data for this area in the Rolesville, NC region is from NOAA Atlas 14. This data contains a depth-duration-frequency (DDF) table describing rainfall depth versus time for varying return periods in the area. These rainfall depths are input into the meteorological model within PondPack for peak flow rate calculations. Please reference the precipitation information within the Miscellaneous Site Information section of this report for additional information.
- On-site and off-site soils were determined using best available GIS data sources.
- Soil Conservation Service Curve Numbers (SCS CN) were selected from Table 2 of the USDA TR-55 for the land use that is most similar to the zoning type or cover condition.
- Land cover conditions for the pre-development condition were taken from survey provided by WithersRavenel and aerial imagery for the site. Land cover conditions for the post-development condition were taken from the proposed layout. Offsite cover conditions were based on GIS-based zoning mapping, provided by the Town of Rolesville.
- The time of concentration was calculated using SCS TR-55 (Segmental Approach, 1986). The Tc flow path can be divided into three segments: overland flow, concentrated flow, and channel flow. The travel time was then computed for each segment, from which the overall time of concentration was determined by taking the sum of each segmental time.
- Existing topographic information used in this analysis is from survey provided by WithersRavenel and QL2 LiDAR from North Carolina's Spatial Data Download.
- PondPack Version V8i was used in determining the pre- & post-development peak flow rates for the 1- and 10-year storm events, as well as routing calculations for the proposed stormwater control measures.
- For 100-year storm routing calculations, a "worst-case" condition was modeled in order to ensure the proposed facility would safely pass the 100-year storm event. The assumptions used in this scenario are as follows:
  - The starting water surface elevation in the facility, just prior to the 100-year storm event, is at the invert of the secondary orifice. This scenario could occur as a result of a clogged primary orifice or a rainfall event that lingers for several days. This could also occur as a result of several rainfall events in a series, before the low-flow orifice has an opportunity to draw down the storage pool.
  - Approximately 6-inches of freeboard is provided between the peak elevation during the "worst-case" scenario and the top of the dam for the proposed facility.

To meet the above Town of Rolesville standards, thirteen stormwater control measures (SCMs) have been proposed, 5 of which are included in CD Package 2 and thus outlined in this SIA.

## DISCUSSION OF RESULTS

### PEAK RUNOFF CONTROL REQUIREMENTS

As shown in the Summary of Results section of this SIA, the proposed stormwater control measures provide the necessary peak runoff control for the proposed build-out condition of the development such that there are no calculated increases in the 1- and 10-year storm events at any point of analysis leaving the site.

## POLLUTANT AND NUTRIENT CONTROL REQUIREMENTS

The proposed SCM is designed to the Minimum Design Criteria of the NCDEQ Stormwater Design Manual. Therefore, the proposed development is treated for 85% TSS removal and provides nitrogen and phosphorus treatment.

## CONCLUSION

If the development on this tract is built as proposed within this report, then the requirements set forth in Town of Rolesville regulations will be met without additional stormwater management facilities. However, modifications to the proposed development may require that this analysis be revised. Some modifications that would **require** this analysis to be revised include:

1. The proposed site impervious surface exceeds the amount accounted for in this report.
2. The post-development watershed breaks change significantly from those used to prepare this report.

The above modifications may result in the assumptions within this report becoming invalid. The computations within this report will need to be revisited if any of the above conditions become apparent as development of the proposed site moves forward.

<b>1</b>	SUMMARY OF RESULTS
<b>2</b>	MISCELLANEOUS SITE INFORMATION
<b>3</b>	PRE-DEVELOPMENT HYDROLOGIC CALCULATIONS
<b>4</b>	POST-DEVELOPMENT HYDROLOGIC CALCULATIONS
<b>5</b>	STORMWATER CONTROL MEASURE 'B' DESIGN FILES
<b>6</b>	STORMWATER CONTROL MEASURE 'G' DESIGN FILES
<b>7</b>	STORMWATER CONTROL MEASURE 'H' DESIGN FILES
<b>8</b>	STORMWATER CONTROL MEASURE 'I' DESIGN FILES
<b>9</b>	STORMWATER CONTROL MEASURE 'J' DESIGN FILES

## *SUMMARY OF RESULTS*

RELEASE RATE MANAGEMENT RESULTS

POINT OF ANALYSIS #1			
Return Period	Pre-Dev [cfs]	Post-Dev [cfs]	% Increase [%]
1-Year	283.5	215.8	-24%
10-Year	545.3	500.4	-8%
POINT OF ANALYSIS #2			
Return Period	Pre-Dev [cfs]	Post-Dev [cfs]	% Increase [%]
1-Year	77.3	70.0	-9%
10-Year	153.0	138.6	-9%
POINT OF ANALYSIS #3			
Return Period	Pre-Dev [cfs]	Post-Dev [cfs]	% Increase [%]
1-Year	8.2	5.8	-29%
10-Year	21.2	14.6	-31%
POINT OF ANALYSIS #4			
Return Period	Pre-Dev [cfs]	Post-Dev [cfs]	% Increase [%]
1-Year	344.2	247.4	-28%
10-Year	704.1	624.0	-11%
POINT OF ANALYSIS #5			
Return Period	Pre-Dev [cfs]	Post-Dev [cfs]	% Increase [%]
1-Year	359.7	279.8	-22%
10-Year	787.2	700.7	-11%

STORMWATER CONTROL MEASURE 'B' SUMMARY

Design Drainage Area =	10.26	ac
Design Impervious Area =	6.11	ac
% Impervious =	59.6%	
Top of Dam =	382.00	ft
NWSE =	376.00	ft
WQv Ponding Elevation =	377.86	ft
Required Main Pool Surface Area at NWSE =	6,766	sf
Provided Main Pool Surface Area at NWSE =	6,928	sf
WQv Orifice Diameter =	2.00	in
WQv Orifice Invert Elevation =	376.00	ft
Riser Size =	4' x 4'	
Riser Crest =	380.00	ft
Number of Orifices =	3	
Orifice Invert Elevation =	379.00	ft
Orifice Dimensions	3'W x 0.5' H	
Barrel Diameter =	24	in
# of Barrels =	1	
Upstream Invert =	375.00	ft
Downstream Invert =	374.00	ft
Length =	50	ft
Slope =	0.0200	ft/ft

STORMWATER CONTROL MEASURE 'B' ROUTING RESULTS

Return Period	Inflow [cfs]	Outflow [cfs]	Max. WSE [ft]	Freeboard [ft]
1-Year	29.9	1.1	379.11	2.89
10-Year	55.8	22.8	380.13	1.87
25-Year	64.7	31.6	380.58	1.42
100-Year	77.5	34.8	381.20	0.80

STORMWATER CONTROL MEASURE 'G' SUMMARY

Design Drainage Area =	13.66	ac
Design Impervious Area =	8.16	ac
% Impervious =	59.8%	
Top of Dam =	346.00	ft
NWSE =	340.00	ft
WQv Ponding Elevation =	341.58	ft
Required Main Pool Surface Area at NWSE =	11,552	sf
Provided Main Pool Surface Area at NWSE =	12,421	sf
WQv Orifice Diameter =	2.50	in
WQv Orifice Invert Elevation =	340.00	ft
Riser Size =	5' x 5'	
Riser Crest =	345.00	ft
Number of Weirs =	3	
Weir Length =	48.00	in
Orifice Invert El. =	343.75	ft
Barrel Diameter =	36	in
# of Barrels =	1	
Upstream Invert =	339.50	ft
Downstream Invert =	339.00	ft
Length =	48.5	ft
Slope =	0.0103	ft/ft

STORMWATER CONTROL MEASURE 'G' ROUTING RESULTS

Return Period	Inflow [cfs]	Outflow [cfs]	Max. WSE [ft]	Freeboard [ft]
1-Year	45.5	0.4	343.76	2.24
10-Year	79.4	20.6	344.43	1.57
25-Year	90.8	41.4	344.84	1.16
100-Year	107.2	62.8	345.33	0.67

STORMWATER CONTROL MEASURE 'H' SUMMARY

Design Drainage Area =	16.40	ac
Design Impervious Area =	9.15	ac
% Impervious =	55.8%	
Top of Dam =	336.00	ft
NWSE =	330.00	ft
WQv Ponding Elevation =	331.54	ft
Required Main Pool Surface Area at NWSE =	13,269	sf
Provided Main Pool Surface Area at NWSE =	14,123	sf
WQv Orifice Diameter =	2.75	in
WQv Orifice Invert Elevation =	330.00	ft
Riser Size =	6' x 6'	
Riser Crest =	335.00	ft
Number of Orifices =	3	
Orifice Invert Elevation =	333.75	ft
Orifice Dimensions =	5'W x 0.5'H	
Barrel Diameter =	42	in
# of Barrels =	1	
Upstream Invert =	329.50	ft
Downstream Invert =	328.00	ft
Length =	153.14	ft
Slope =	0.0098	ft/ft

STORMWATER CONTROL MEASURE 'H' ROUTING RESULTS

Return Period	Inflow [cfs]	Outflow [cfs]	Max. WSE [ft]	Freeboard [ft]
1-Year	52.3	0.6	333.77	2.23
10-Year	93.4	23.9	334.43	1.57
25-Year	107.2	36.3	335.00	1.00
100-Year	127.2	72.4	335.55	0.45

STORMWATER CONTROL MEASURE 'I' SUMMARY

Design Drainage Area =	8.37	ac
Design Impervious Area =	4.54	ac
% Impervious =	54.3%	
Top of Dam =	324.00	ft
NWSE =	318.00	ft
WQv Ponding Elevation =	319.67	ft
Required Main Pool Surface Area at NWSE =	5,024	sf
Provided Main Pool Surface Area at NWSE =	5,157	sf
WQv Orifice Diameter =	1.75	in
WQv Orifice Invert Elevation =	318.00	ft
Riser Size =	5' x 5'	
Riser Crest =	323.00	ft
Number of Orifices =	3	
Orifice Invert Elevation =	322.00	ft
Orifice Dimensions =	4'W X 0.75' H	
Barrel Diameter =	36	in
# of Barrels =	1	
Upstream Invert =	317.00	ft
Downstream Invert =	316.00	ft
Length =	48.5	ft
Slope =	0.0206	ft/ft

STORMWATER CONTROL MEASURE 'I' ROUTING RESULTS

Return Period	Inflow [cfs]	Outflow [cfs]	Max. WSE [ft]	Freeboard [ft]
1-Year	24.4	0.2	321.78	2.22
10-Year	45.5	13.6	322.38	1.62
25-Year	52.8	27.1	322.76	1.24
100-Year	63.2	44.4	323.19	0.81

STORMWATER CONTROL MEASURE 'J' SUMMARY

Design Drainage Area =	14.19	ac
Design Impervious Area =	6.69	ac
% Impervious =	47.2%	
Top of Dam =	316.00	ft
NWSE =	310.00	ft
WQv Ponding Elevation =	311.65	ft
Required Main Pool Surface Area at NWSE =	8,495	sf
Provided Main Pool Surface Area at NWSE =	8,977	sf
WQv Orifice Diameter =	2.25	in
WQv Orifice Invert Elevation =	310.00	ft
Riser Size =	5' x 5'	
Riser Crest =	314.00	ft
Number of Orifices =	1	
Orifice Invert El. =	313.00	ft
Orifice Dimensions =	4'W X 0.5'H	
Barrel Diameter =	36	in
# of Barrels =	1	
Upstream Invert =	309.50	ft
Downstream Invert =	309.00	ft
Length =	48.5	ft
Slope =	0.0103	ft/ft

STORMWATER CONTROL MEASURE 'J' ROUTING RESULTS

Return Period	Inflow [cfs]	Outflow [cfs]	Max. WSE [ft]	Freeboard [ft]
1-Year	37.4	1.2	313.18	2.82
10-Year	73.4	23.1	314.35	1.65
25-Year	85.9	47.9	314.72	1.28
100-Year	104.1	67.8	315.16	0.84

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10-Year	21.2	14.6	-31%
POINT OF ANALYSIS #4			
Return Period	Pre-Dev [cfs]	Post-Dev [cfs]	% Increase [%]
1-Year	344.2	247.4	-28%
10-Year	704.1	624.0	-11%
POINT OF ANALYSIS #5			
Return Period	Pre-Dev [cfs]	Post-Dev [cfs]	% Increase [%]
1-Year	297.7	231.5	-22%
10-Year	664.9	590.9	-11%

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STORMWATER CONTROL MEASURE 'J' SUMMARY

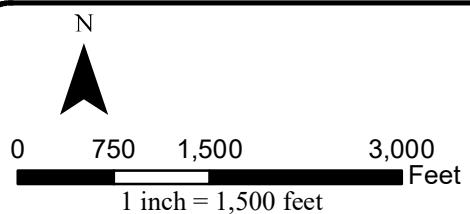
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## *MISCELLANEOUS SITE INFORMATION*

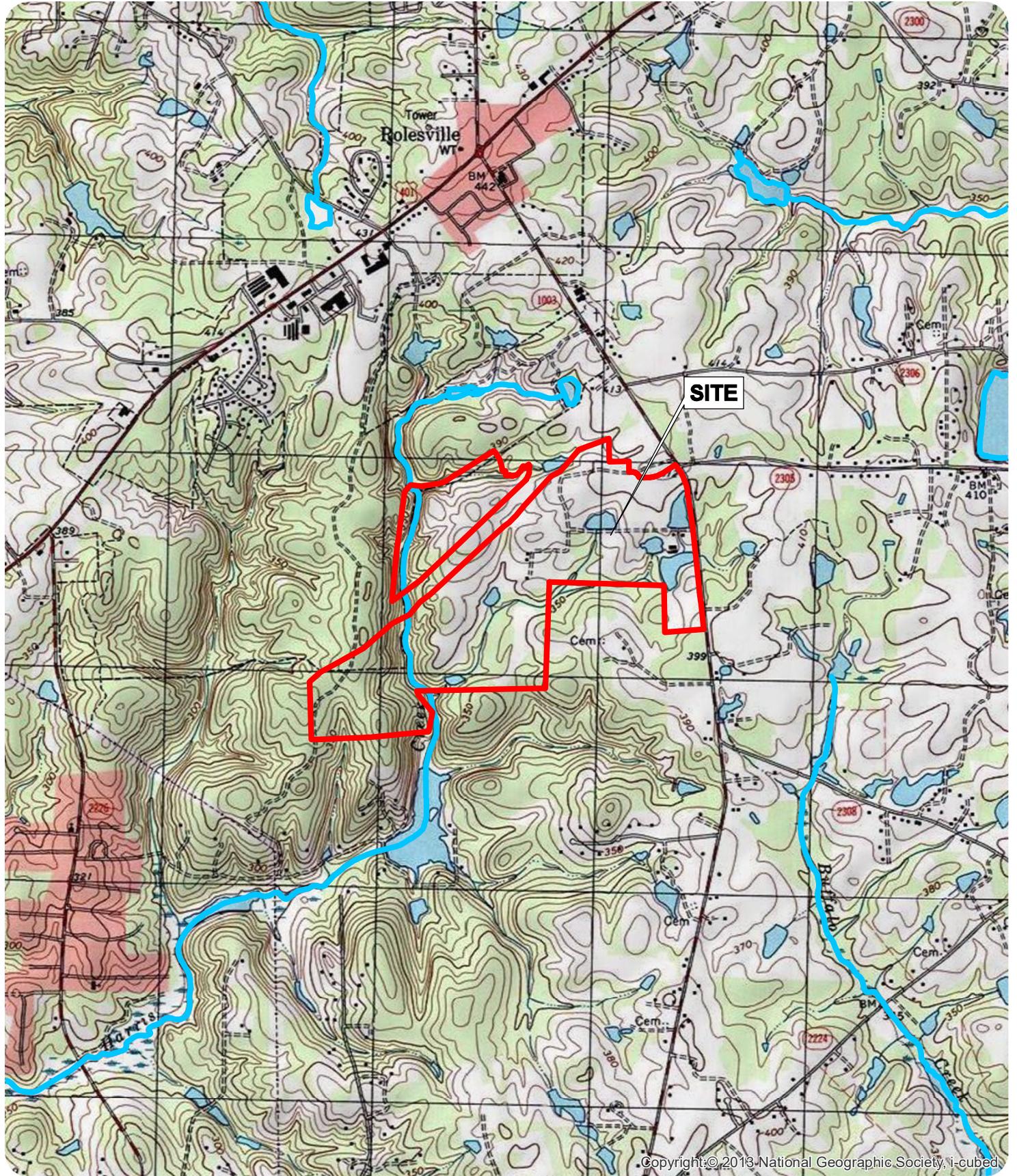
**The Point**  
AWH-20000



**THE POINT**  
**SITE AERIAL MAP**  
**PROJECT #: AWH-20000**  
**ROLESVILLE, NORTH CAROLINA**



**MCADAMS**



0 1,000 2,000 4,000  
Feet  
1 inch = 2,000 feet

**THE POINT**  
**USGS TOPO MAP**  
**PROJECT #: AWH-20000**  
**ROLESVILLE, NORTH CAROLINA**



**MCADAMS**

.0315

## NEUSE RIVER BASIN

Name of Stream	Description	Class	Class Date	Index No.
NEUSE RIVER	From a point 0.5 mile upstream of Town of Wake Forest proposed water supply intake to Town of Wake Forest proposed water supply intake	WS-IV;NSW,CA	07/01/04	27-(22)
NEUSE RIVER	From Town of Wake Forest proposed water supply intake to mouth of Beddingfield Creek	C;NSW	08/03/92	27-(22.5)
Smith Creek	From source to a point 0.3 mile downstream of Franklin-Wake County Line	WS-II;HQW,NSW	08/03/92	27-23-(1)
Smith Creek (Wake Forest Reservoir)	From a point 0.3 mile downstream of Franklin-Wake County Line to dam at Wake Reservoir	WS-II;HQW,NSW, CA	08/03/92	27-23-(1.5)
Smith Creek	From dam at Wake Forest Reservoir to Neuse River	C;NSW	05/01/88	27-23-(2)
Austin Creek (Mitchell Pond)	From source to Smith Creek	C;NSW	07/01/96	27-23-3
Hatters Branch	From source to Smith Creek	C;NSW	05/01/88	27-23-4
Spring Branch	From source to Hatters Branch	C;NSW	05/01/88	27-23-4-1
Sanford Creek	From source to Smith Creek	C;NSW	05/01/88	27-23-5
Toms Creek (Mill Creek)	From source to Neuse River	C;NSW	05/01/88	27-24
Perry Creek (Greshams Lake)	From source to dam at Greshams Lake	B;NSW	05/01/88	27-25-(1)
Perry Creek	From dam at Greshams Lake to Neuse River	C;NSW	05/01/88	27-25-(2)
Unnamed Tributary near Neuse	From source to dam at Camp Durant	B;NSW	05/01/88	27-25-3-(1)
Unnamed Tributary near Neuse	From dam at Camp Durant to Perry Creek	C;NSW	05/01/88	27-25-3-(2)
<b>Harris Creek (Peeples Creek) (Wake Crossroads Lake)</b>	<b>From source to Neuse River</b>	<b>C;NSW</b>	<b>05/01/88</b>	<b>27-26</b>
Hodges Mill Creek (Lake Mirl)	From source to water intake at Lake Mirl	B;NSW	05/01/88	27-26-1-(1)
Hodges Mill Creek	From water intake at Lake Mirl to Harris Creek	C;NSW	05/01/88	27-26-1-(2)
Beaverdam Creek (west side of Neuse River)	From source to Neuse River	C;NSW	05/01/88	27-27
Rocky Creek	From source to Neuse River	C;NSW	05/01/88	27-28
Beaverdam Creek (east side of Neuse River) (Neuseco Lake, Beaverdam Lake)	From soruce to Neuse River	C;NSW	05/01/88	27-29
Bridges Creek (Bridges Lake)	From source to Neuse River	C;NSW	05/01/88	27-30
Milburnie Creek (Milburnie Lake)	From source to Neuse River	C;NSW	05/01/88	27-31
Mango Creek	From source to Neuse River	C;NSW	05/01/88	27-32
Crabtree Creek	From source to backwaters of Crabtree Lake	C;NSW	05/01/88	27-33-(1)
Turkey Creek	From source to Crabtree Creek	C;NSW	05/01/88	27-33-2
Coles Branch	From source to Crabtree Creek	C;NSW	05/01/88	27-33-3
South Fork Coles Branch	From source to Coles Branch	C;NSW	05/01/88	27-33-3-1
Crabtree Creek (Crabtree Lake)	From backwaters of Crabtree Lake to mouth of Richlands Creek	B;NSW	04/01/94	27-33-(3.5)



This digital Flood Insurance Rate Map (FIRM) was produced through a unique cooperative partnership between the State of North Carolina and the Federal Emergency Management Agency (FEMA). The State of North Carolina has implemented a long term approach to floodplain management to decrease the costs associated with flooding. This is demonstrated by the State's commitment to map standard areas at the same level. As a part of this effort, the State of North Carolina has entered a Cooperating Technical State agreement with FEMA to produce and maintain this digital FIRM.

## FLOOD HAZARD INFORMATION

**SEE FIS REPORT FOR ZONE DESCRIPTIONS AND INDEX MAP**  
**THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT**  
[HTTP://FRIS.NC.GOV/FRIS](http://FRIS.NC.GOV/FRIS)

<b>SPECIAL FLOOD HAZARD AREAS</b>	Without Base Flood Elevation (BFE) Zone A,V,A99
	With BFE or Depth Zone AE, AO, AH, VE, AR Regulatory Floodway
	0.2% Annual Chance Flood Hazard, Areas of 1% Annual Chance Flood with Average Depth Less Than One Foot or With Drainage Areas of Less Than One Square Mile Zone X
	Future Conditions 1% Annual Chance Flood Hazard Zone X
	Area with Reduced Flood Risk due to Levee See Notes Zone X
	Areas Determined to be Outside the 0.2% Annual Chance Floodplain Zone X
<b>OTHER AREAS OF FLOOD HAZARD</b>	Channel, Culvert, or Storm Sewer
<b>OTHER AREAS</b>	Accredited or Provisionally Accredited Levee, Dike, or Floodwall
<b>GENERAL STRUCTURES</b>	Non-accredited Levee, Dike, or Floodwall
	BM5510 x North Carolina Geodetic Survey bench mark
	BM5510 ⊗ National Geodetic Survey bench mark
	Contractor Est. NCFMP Survey bench mark
	012-18-2 Cross Sections with 1% Annual Chance Water Surface Elevation (BFE)
	Coastal Transect
	Coastal Transect Baseline
	Profile Baseline
	Hydrographic Feature
	Limit of Study
	Jurisdiction Boundary

## NOTES TO USERS

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Map Service Center website at <http://msc.fema.gov>. An accompanying Flood Insurance Study report, Letter of Map Revision (LOMR) or Letter of Map Amendment (LOMA) revising portions of this panel, and digital versions of this FIRM may be found at <http://www.ncfloodmaps.com>, or contact the FEMA Map Service Center at <http://www.floodmaps.com>.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Map Service Center at the number listed above.

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To determine if flood insurance is available in the community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Base map information shown on this FIRM was provided in digital format by the North Carolina Floodplain Mapping Program (NCFMP). The source of this information can be determined from the metadata available in the digital FLOOD database and in the Technical Support Data Notebook (TSDN).

**ACCREDITED LEVEE NOTES TO USERS:** If an accredited levee note appears on this panel check with your local community to obtain more information such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as primary protection. To maintain accreditation, the owner or operator of the levee is required to make the data and documentation available to the State of North Carolina or the FIRM review teams. If the community or owner does not provide the necessary data and documentation or if the data and documentation provided indicates the levee system does not comply with Section 65.10 requirements, FEMA will revise the flood hazard and risk information for this area to reflect de-accreditation of the levee system. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at <http://www.fema.gov/business/rifp/index.htm>.

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**LIMIT OF MODERATE WAVE ACTION NOTES TO USERS:** For some coastal flooding zones the AE Zone category has been divided by a Limit of Moderate Wave Action (LIMA). The LIMA represents the approximate landward limit of the 1.5-foot breaking wave. The effects of wave hazards between the VE Zone and the LIMA (or between the shoreline and the LIMA for areas where VE Zones are not identified) will be similar to, but less severe than those in the VE Zone.

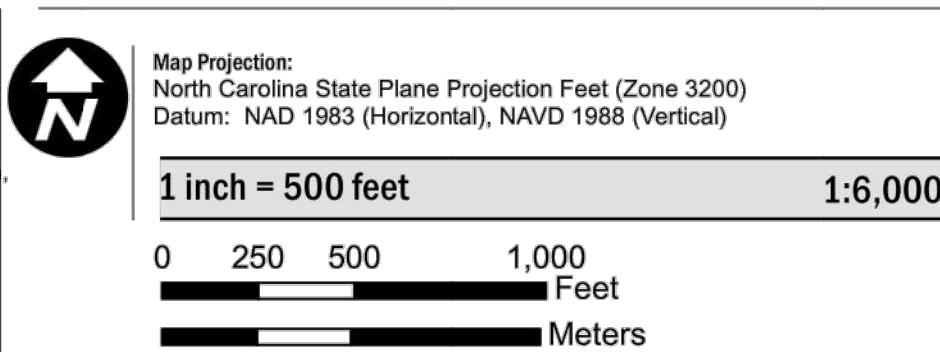
### Limit of Moderate Wave Action (LIMA)

**COASTAL BARRIER RESOURCES SYSTEM (CBRS) NOTE**  
 This map may include approximate boundaries of the CBRS for planning purposes only. Flood insurance is not available within CBRS areas for structures that are newly built or substantially improved on or after the date(s) indicated on the map. For more information see [http://www.fema.gov/habitatconservation/coastal\\_barrier.html](http://www.fema.gov/habitatconservation/coastal_barrier.html), the FIS Report, or call the U.S. Fish and Wildlife Service Customer Service Center at 1-800-344-WILD.

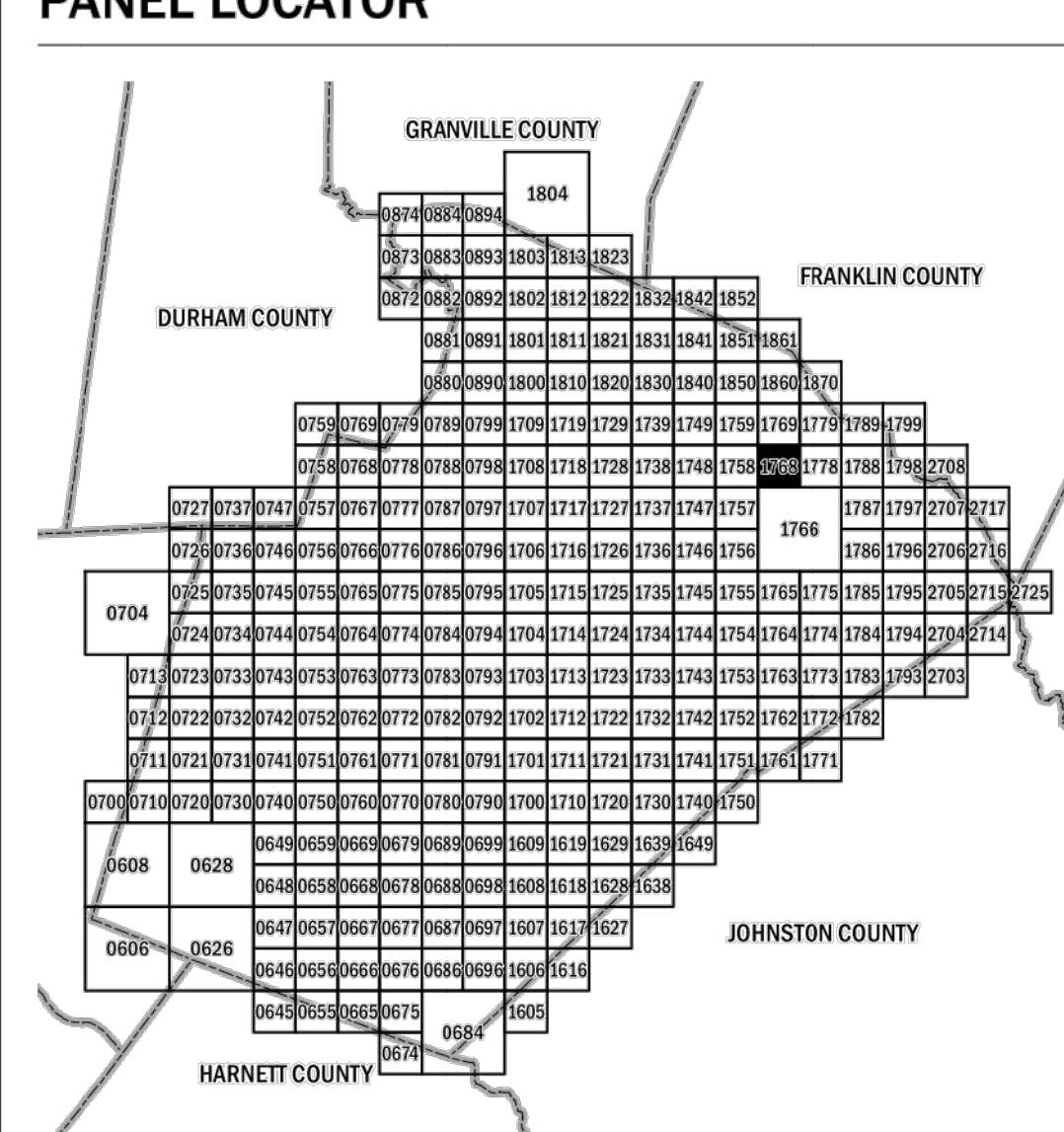
### CBRS Area

### Otherwise Protected Area

## SCALE



## PANEL LOCATOR



NORTH CAROLINA FLOODPLAIN MAPPING PROGRAM  
NATIONAL FLOOD INSURANCE PROGRAM  
FLOOD INSURANCE RATE MAP

**NORTH CAROLINA**

PANEL 1768



Panel Contains:

COMMUNITY  
ROLESVILLE, TOWN OF  
WAKE COUNTY

CID PANEL SUFFIX  
370468 1768 J  
370368 1768 J

**FEMA**  
**National Flood Insurance Program**



MAP NUMBER  
3720176800J  
MAP REVISED  
05/02/06



This digital Flood Insurance Rate Map (FIRM) was produced through a unique cooperative partnership between the State of North Carolina and the Federal Emergency Management Agency (FEMA). The State of North Carolina has implemented a long term approach to floodplain management to decrease the costs associated with flooding. This is demonstrated by the State's commitment to map flood hazard areas at the local level. As a part of this effort, the State of North Carolina has entered a Cooperating Technical State agreement with FEMA to produce and maintain this digital FIRM.

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OTHER AREAS	Area with Reduced Flood Risk due to Levee See Notes Zone X
	Areas Determined to be Outside the 0.2% Annual Chance Floodplain Zone X

GENERAL STRUCTURES	Channel, Culvert, or Storm Sewer Accredited or Provisionally Accredited Levee, Dike, or Floodwall Non-accredited Levee, Dike, or Floodwall
	BM5510 x BM5510 ⊗ BM5510 ⊖ Contractor Est. NCFMP Survey bench mark Cross Sections with 1% Annual Chance Water Surface Elevation (BFE)

OTHER FEATURES	Coastal Transect Coastal Transect Baseline Profile Baseline Hydrographic Feature Limit of Study Jurisdiction Boundary
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### CBRS Area

### Otherwise Protected Area

## SCALE

Map Projection:  
North Carolina State Plane Projection Feet (Zone 3200)

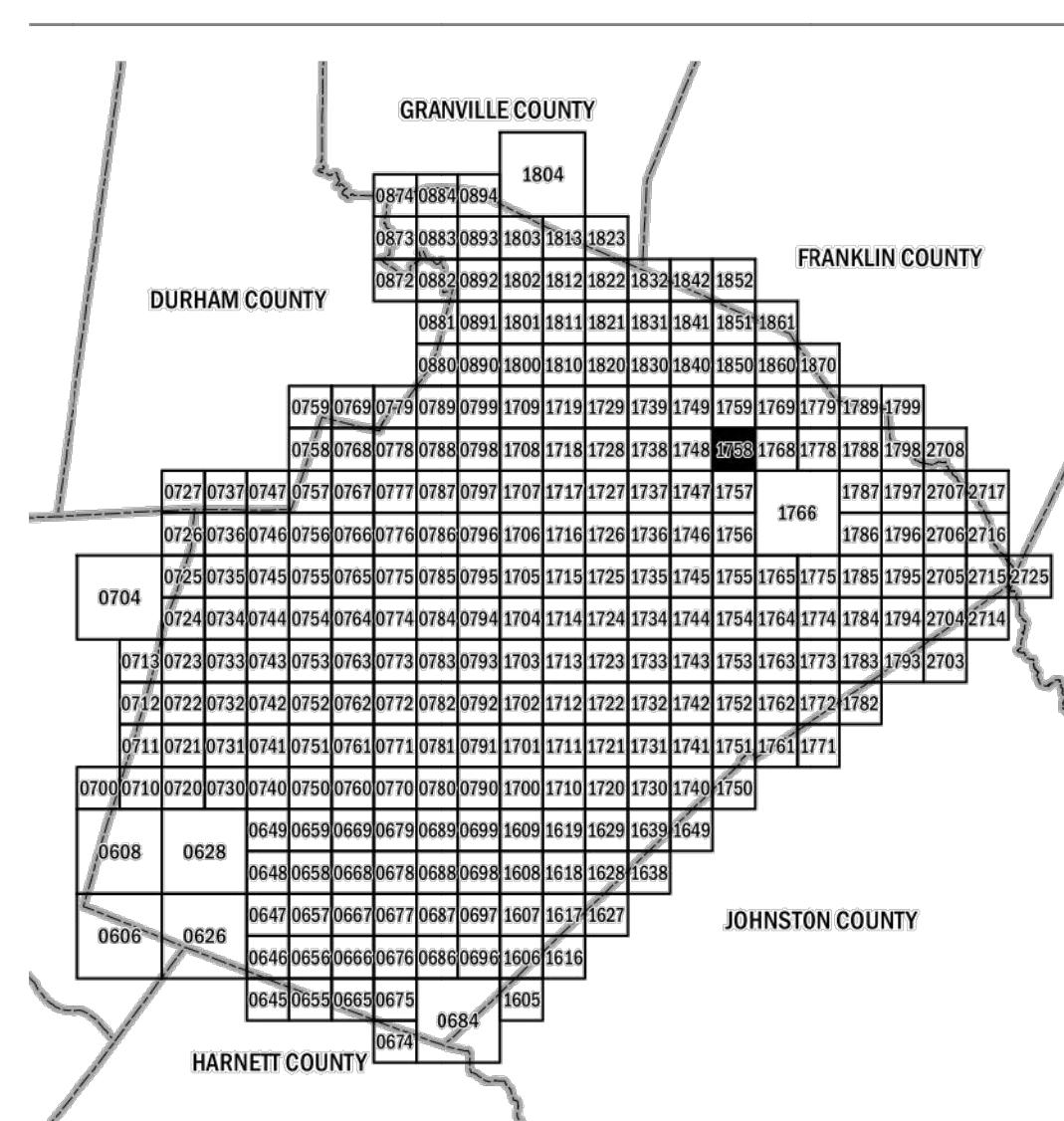
Datum: NAD 1983 (Horizontal), NAVD 1988 (Vertical)

1 inch = 500 feet 1:6,000

0 250 500 1,000 Feet

0 75 150 300 Meters

## PANEL LOCATOR



NORTH CAROLINA FLOODPLAIN MAPPING PROGRAM  
NATIONAL FLOOD INSURANCE PROGRAM  
FLOOD INSURANCE RATE MAP

NORTH CAROLINA



PANEL 1758

Panel Contains:

COMMUNITY  
ROLESVILLE, TOWN OF  
WAKE COUNTY

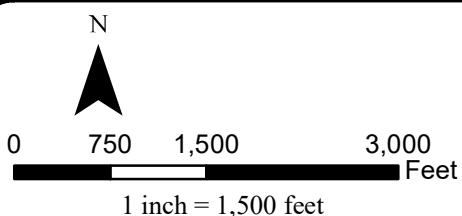
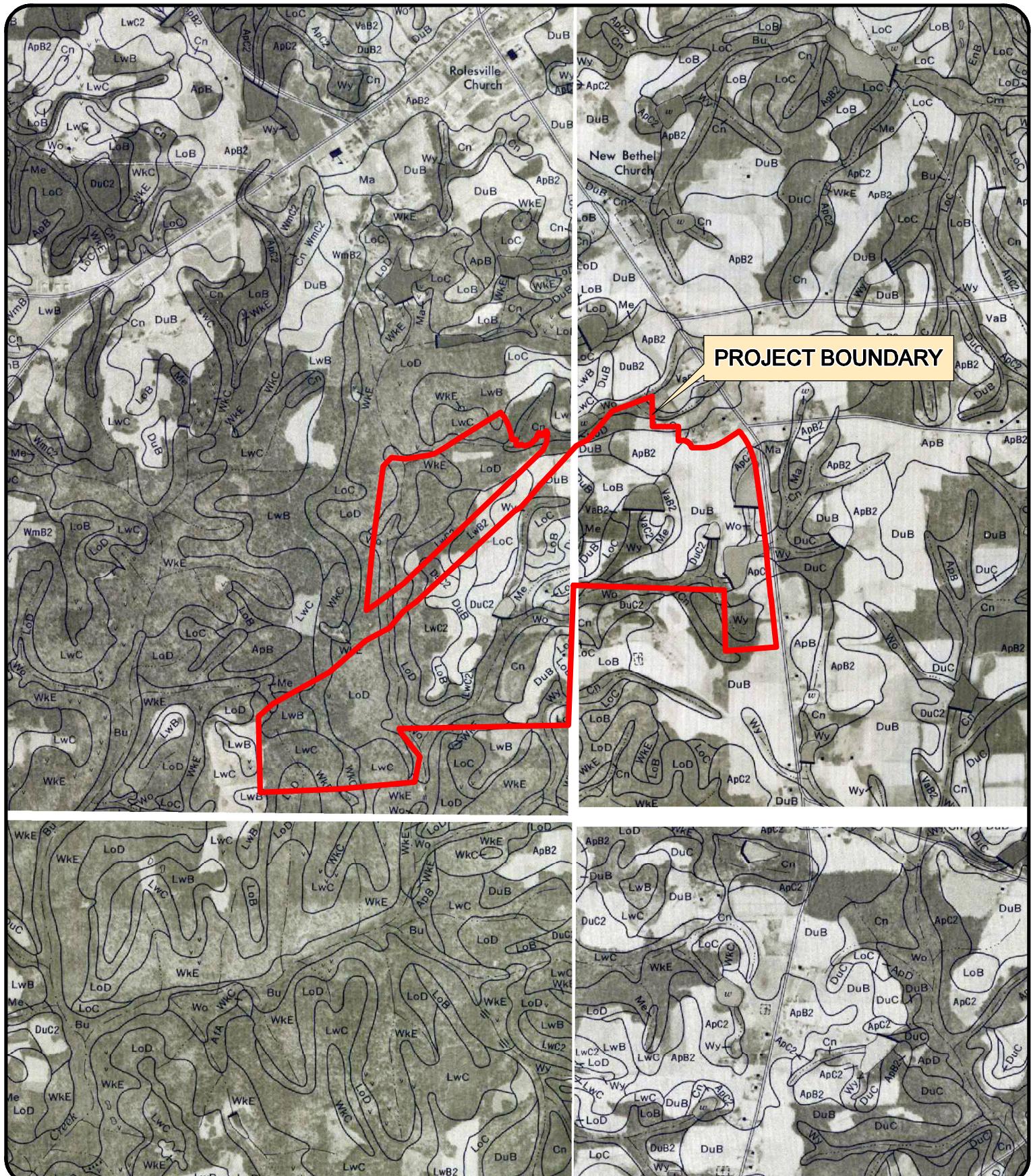
CID PANEL SUFFIX  
370468 1758 J  
370368 1758 J

FEMA

National Flood Insurance Program



MAP NUMBER  
3720175800J  
MAP REVISED  
05/02/06

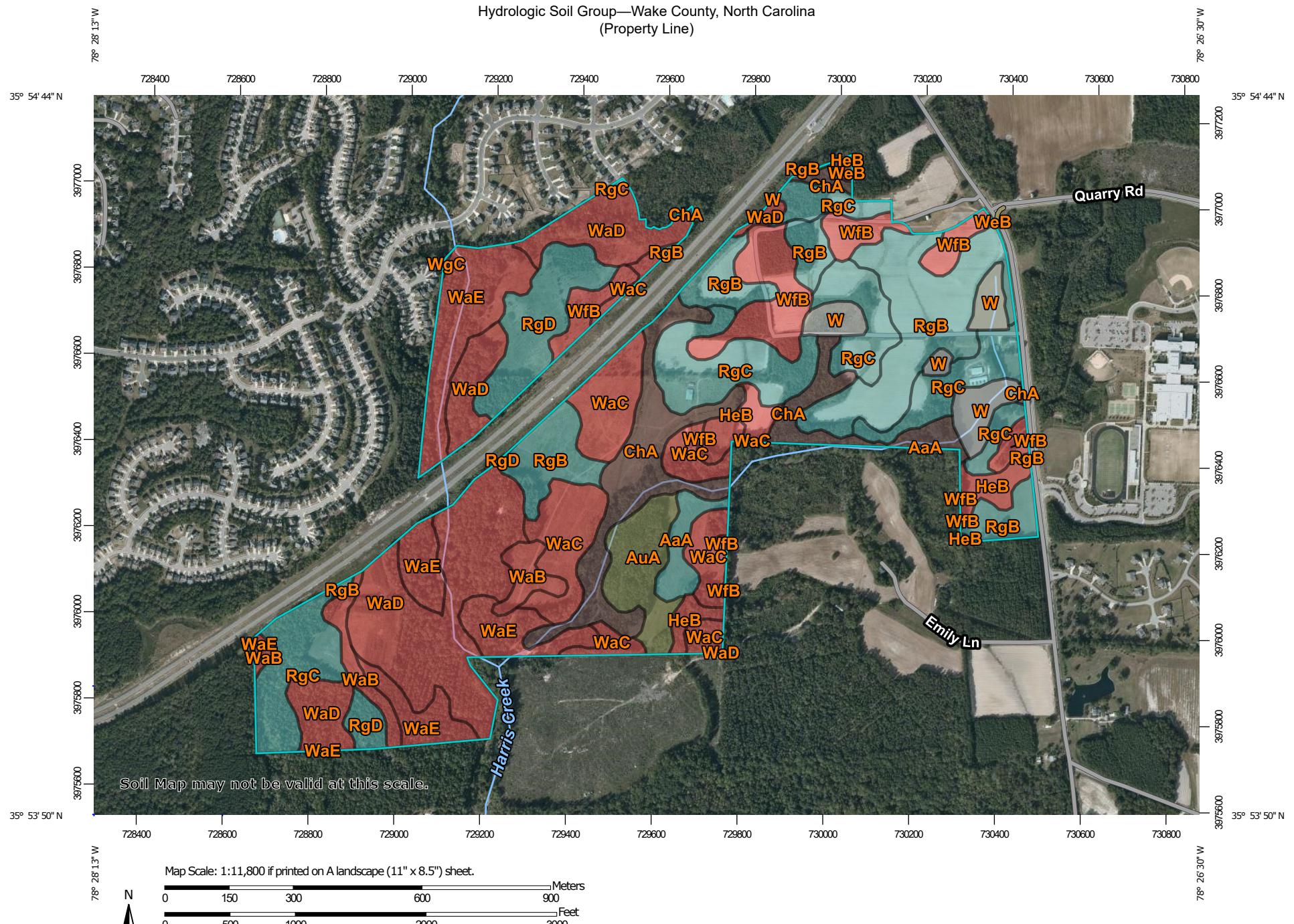


**THE POINT**  
**SOIL MAP**  
**PROJECT #:** AWH-20000  
ROLESVILLE, NORTH CAROLINA



McADAMS

Hydrologic Soil Group—Wake County, North Carolina  
(Property Line)



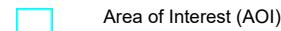
Natural Resources  
Conservation Service

Web Soil Survey  
National Cooperative Soil Survey

6/3/2020  
Page 1 of 4

## MAP LEGEND

### Area of Interest (AOI)



### Soils

#### Soil Rating Polygons

	A
	A/D
	B
	B/D
	C
	C/D
	D
	Not rated or not available

#### Soil Rating Lines

	A
	A/D
	B
	B/D
	C
	C/D
	D
	Not rated or not available

#### Soil Rating Points

	A
	A/D
	B
	B/D

### C

### C/D

### D

### Not rated or not available

### Water Features

#### Streams and Canals

### Transportation

#### Rails

#### Interstate Highways

#### US Routes

#### Major Roads

#### Local Roads

### Background

#### Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Wake County, North Carolina

Survey Area Data: Version 18, Sep 16, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 11, 2019—Oct 19, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

## Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
AaA	Altavista fine sandy loam, 0 to 4 percent slopes, rarely flooded	C	4.1	1.4%
AuA	Augusta fine sandy loam, 0 to 2 percent slopes, rarely flooded	C/D	10.1	3.3%
ChA	Chewacla and Wehadkee soils, 0 to 2 percent slopes, frequently flooded	B/D	27.0	8.9%
HeB	Helena sandy loam, 2 to 6 percent slopes	D	7.1	2.4%
RgB	Rawlings-Rion complex, 2 to 6 percent slopes	C	43.5	14.4%
RgC	Rawlings-Rion complex, 6 to 10 percent slopes	C	45.6	15.1%
RgD	Rawlings-Rion complex, 10 to 15 percent slopes	C	15.0	5.0%
W	Water		9.7	3.2%
WaB	Wake-Rolesville complex, 2 to 6 percent slopes, very rocky	D	7.4	2.4%
WaC	Wake-Rolesville complex, 6 to 10 percent slopes, very rocky	D	29.0	9.6%
WaD	Wake-Rolesville complex, 10 to 15 percent slopes, very rocky	D	51.1	16.9%
WaE	Wake-Rolesville complex, 15 to 25 percent slopes, very rocky	D	28.9	9.6%
WeB	Wedowee sandy loam, 2 to 6 percent slopes	D	0.2	0.1%
WfB	Wedowee-Saw complex, 2 to 6 percent slopes	D	22.9	7.6%
WgC	Wedowee-Urban land complex, 6 to 15 percent slopes	D	0.1	0.0%
<b>Totals for Area of Interest</b>			<b>301.6</b>	<b>100.0%</b>

## Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

**Group A.** Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

**Group B.** Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

**Group C.** Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

**Group D.** Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

## Rating Options

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff:* None Specified

*Tie-break Rule:* Higher

**NOAA Atlas 14, Volume 2, Version 3****Location name:** Wake Forest, North Carolina, USA\***Latitude:** 35.9053°, **Longitude:** -78.452°**Elevation:** 354.67 ft\*\*

\* source: ESRI Maps

\*\* source: USGS

**POINT PRECIPITATION FREQUENCY ESTIMATES**

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M. Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

[PF tabular](#) | [PF graphical](#) | [Maps & aerials](#)
**PF tabular**

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	<b>0.403</b> (0.369-0.442)	<b>0.468</b> (0.429-0.512)	<b>0.534</b> (0.489-0.582)	<b>0.600</b> (0.548-0.654)	<b>0.666</b> (0.606-0.726)	<b>0.718</b> (0.651-0.783)	<b>0.765</b> (0.690-0.834)	<b>0.807</b> (0.723-0.881)	<b>0.853</b> (0.758-0.932)	<b>0.895</b> (0.789-0.979)
10-min	<b>0.644</b> (0.590-0.705)	<b>0.749</b> (0.687-0.818)	<b>0.855</b> (0.783-0.933)	<b>0.959</b> (0.877-1.05)	<b>1.06</b> (0.966-1.16)	<b>1.14</b> (1.04-1.25)	<b>1.22</b> (1.10-1.33)	<b>1.28</b> (1.15-1.40)	<b>1.35</b> (1.20-1.47)	<b>1.41</b> (1.24-1.54)
15-min	<b>0.806</b> (0.738-0.882)	<b>0.942</b> (0.863-1.03)	<b>1.08</b> (0.991-1.18)	<b>1.21</b> (1.11-1.32)	<b>1.35</b> (1.22-1.47)	<b>1.45</b> (1.31-1.58)	<b>1.54</b> (1.39-1.68)	<b>1.61</b> (1.45-1.76)	<b>1.70</b> (1.51-1.86)	<b>1.77</b> (1.56-1.94)
30-min	<b>1.10</b> (1.01-1.21)	<b>1.30</b> (1.19-1.42)	<b>1.54</b> (1.41-1.68)	<b>1.76</b> (1.61-1.92)	<b>1.99</b> (1.81-2.17)	<b>2.18</b> (1.98-2.38)	<b>2.35</b> (2.12-2.57)	<b>2.51</b> (2.25-2.74)	<b>2.70</b> (2.40-2.95)	<b>2.87</b> (2.52-3.14)
60-min	<b>1.38</b> (1.26-1.51)	<b>1.63</b> (1.50-1.78)	<b>1.97</b> (1.81-2.15)	<b>2.29</b> (2.09-2.50)	<b>2.65</b> (2.42-2.89)	<b>2.96</b> (2.68-3.22)	<b>3.24</b> (2.92-3.53)	<b>3.52</b> (3.16-3.85)	<b>3.88</b> (3.45-4.24)	<b>4.18</b> (3.69-4.58)
2-hr	<b>1.61</b> (1.46-1.78)	<b>1.92</b> (1.75-2.10)	<b>2.34</b> (2.13-2.56)	<b>2.75</b> (2.49-3.01)	<b>3.23</b> (2.91-3.54)	<b>3.66</b> (3.28-4.00)	<b>4.07</b> (3.63-4.45)	<b>4.49</b> (3.98-4.91)	<b>5.04</b> (4.42-5.51)	<b>5.52</b> (4.80-6.05)
3-hr	<b>1.71</b> (1.55-1.89)	<b>2.03</b> (1.85-2.24)	<b>2.49</b> (2.26-2.74)	<b>2.94</b> (2.67-3.24)	<b>3.50</b> (3.15-3.84)	<b>3.99</b> (3.58-4.39)	<b>4.49</b> (3.98-4.92)	<b>5.00</b> (4.41-5.48)	<b>5.69</b> (4.96-6.24)	<b>6.32</b> (5.45-6.95)
6-hr	<b>2.05</b> (1.87-2.26)	<b>2.44</b> (2.23-2.68)	<b>2.99</b> (2.72-3.28)	<b>3.54</b> (3.22-3.88)	<b>4.22</b> (3.82-4.62)	<b>4.84</b> (4.35-5.29)	<b>5.46</b> (4.86-5.96)	<b>6.12</b> (5.39-6.67)	<b>7.00</b> (6.10-7.64)	<b>7.82</b> (6.72-8.55)
12-hr	<b>2.41</b> (2.21-2.66)	<b>2.87</b> (2.64-3.15)	<b>3.54</b> (3.24-3.88)	<b>4.21</b> (3.84-4.62)	<b>5.07</b> (4.59-5.53)	<b>5.85</b> (5.26-6.36)	<b>6.64</b> (5.91-7.22)	<b>7.49</b> (6.59-8.14)	<b>8.66</b> (7.50-9.41)	<b>9.76</b> (8.32-10.6)
24-hr	<b>2.86</b> (2.66-3.08)	<b>3.46</b> (3.22-3.73)	<b>4.35</b> (4.04-4.69)	<b>5.06</b> (4.69-5.44)	<b>6.02</b> (5.57-6.49)	<b>6.80</b> (6.27-7.32)	<b>7.60</b> (6.98-8.19)	<b>8.43</b> (7.71-9.09)	<b>9.58</b> (8.71-10.3)	<b>10.5</b> (9.50-11.3)
2-day	<b>3.32</b> (3.09-3.57)	<b>3.99</b> (3.72-4.30)	<b>4.98</b> (4.64-5.37)	<b>5.77</b> (5.35-6.21)	<b>6.83</b> (6.32-7.36)	<b>7.68</b> (7.09-8.27)	<b>8.56</b> (7.87-9.22)	<b>9.46</b> (8.66-10.2)	<b>10.7</b> (9.74-11.6)	<b>11.7</b> (10.6-12.7)
3-day	<b>3.52</b> (3.28-3.77)	<b>4.23</b> (3.94-4.54)	<b>5.25</b> (4.89-5.63)	<b>6.06</b> (5.64-6.50)	<b>7.17</b> (6.64-7.69)	<b>8.05</b> (7.44-8.64)	<b>8.96</b> (8.25-9.62)	<b>9.89</b> (9.07-10.6)	<b>11.2</b> (10.2-12.1)	<b>12.2</b> (11.1-13.2)
4-day	<b>3.72</b> (3.47-3.98)	<b>4.46</b> (4.17-4.77)	<b>5.52</b> (5.15-5.90)	<b>6.35</b> (5.92-6.79)	<b>7.50</b> (6.96-8.01)	<b>8.42</b> (7.79-9.00)	<b>9.36</b> (8.63-10.0)	<b>10.3</b> (9.49-11.1)	<b>11.7</b> (10.7-12.5)	<b>12.7</b> (11.6-13.7)
7-day	<b>4.31</b> (4.04-4.61)	<b>5.15</b> (4.82-5.50)	<b>6.29</b> (5.88-6.71)	<b>7.19</b> (6.72-7.68)	<b>8.43</b> (7.85-9.00)	<b>9.42</b> (8.75-10.1)	<b>10.4</b> (9.66-11.2)	<b>11.5</b> (10.6-12.3)	<b>12.9</b> (11.8-13.9)	<b>14.1</b> (12.8-15.1)
10-day	<b>4.91</b> (4.61-5.24)	<b>5.85</b> (5.48-6.23)	<b>7.04</b> (6.60-7.50)	<b>7.99</b> (7.47-8.50)	<b>9.26</b> (8.64-9.86)	<b>10.3</b> (9.55-10.9)	<b>11.3</b> (10.5-12.0)	<b>12.3</b> (11.4-13.2)	<b>13.7</b> (12.6-14.7)	<b>14.8</b> (13.6-15.9)
20-day	<b>6.59</b> (6.20-7.02)	<b>7.79</b> (7.32-8.29)	<b>9.23</b> (8.67-9.81)	<b>10.4</b> (9.72-11.0)	<b>11.9</b> (11.1-12.7)	<b>13.1</b> (12.2-14.0)	<b>14.3</b> (13.3-15.3)	<b>15.6</b> (14.5-16.6)	<b>17.3</b> (16.0-18.5)	<b>18.6</b> (17.1-19.9)
30-day	<b>8.18</b> (7.72-8.69)	<b>9.63</b> (9.08-10.2)	<b>11.2</b> (10.6-11.9)	<b>12.5</b> (11.7-13.2)	<b>14.1</b> (13.2-15.0)	<b>15.4</b> (14.4-16.3)	<b>16.6</b> (15.5-17.7)	<b>17.9</b> (16.7-19.0)	<b>19.5</b> (18.1-20.9)	<b>20.8</b> (19.3-22.3)
45-day	<b>10.4</b> (9.89-11.0)	<b>12.2</b> (11.6-12.9)	<b>14.0</b> (13.3-14.8)	<b>15.4</b> (14.6-16.2)	<b>17.2</b> (16.3-18.1)	<b>18.6</b> (17.5-19.6)	<b>19.9</b> (18.7-21.0)	<b>21.2</b> (19.9-22.5)	<b>23.0</b> (21.5-24.4)	<b>24.3</b> (22.7-25.8)
60-day	<b>12.5</b> (11.9-13.1)	<b>14.6</b> (13.9-15.4)	<b>16.6</b> (15.7-17.4)	<b>18.1</b> (17.1-19.0)	<b>20.0</b> (19.0-21.1)	<b>21.5</b> (20.3-22.6)	<b>22.9</b> (21.6-24.1)	<b>24.2</b> (22.9-25.6)	<b>26.0</b> (24.5-27.5)	<b>27.4</b> (25.7-29.0)

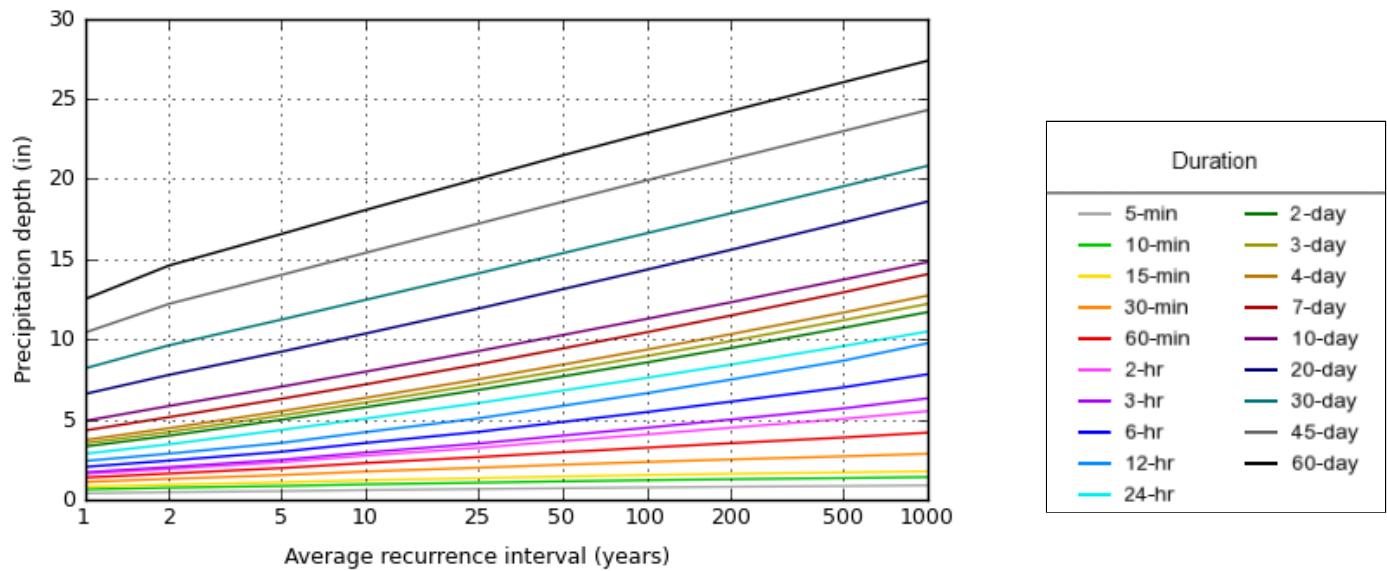
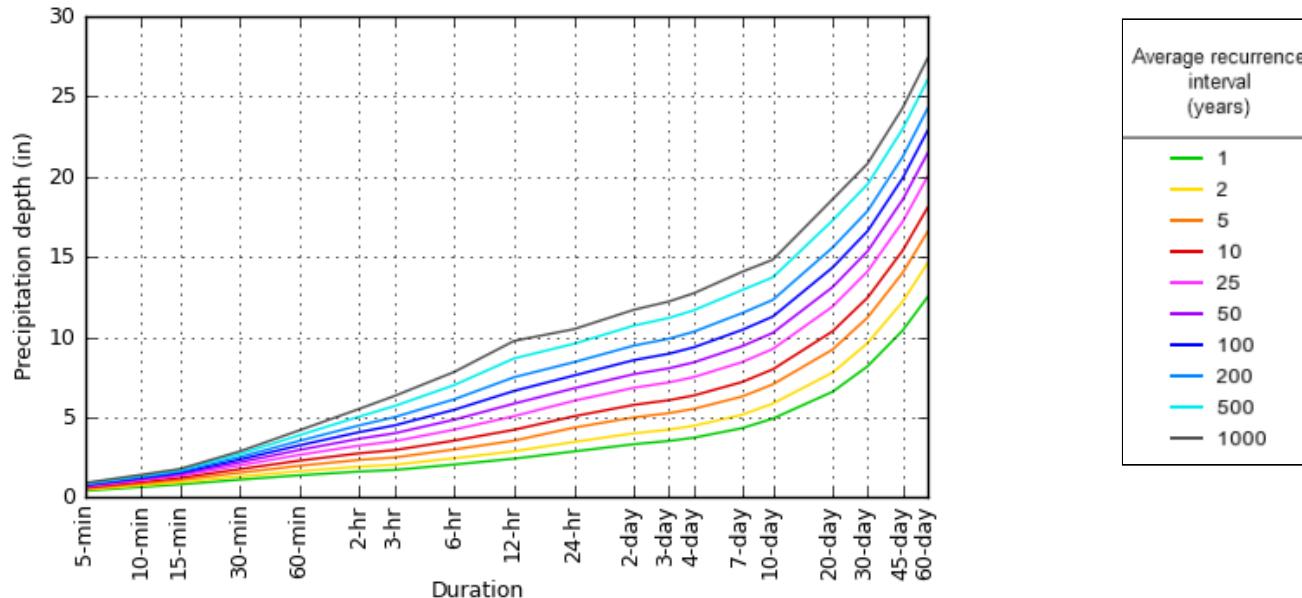
1 Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

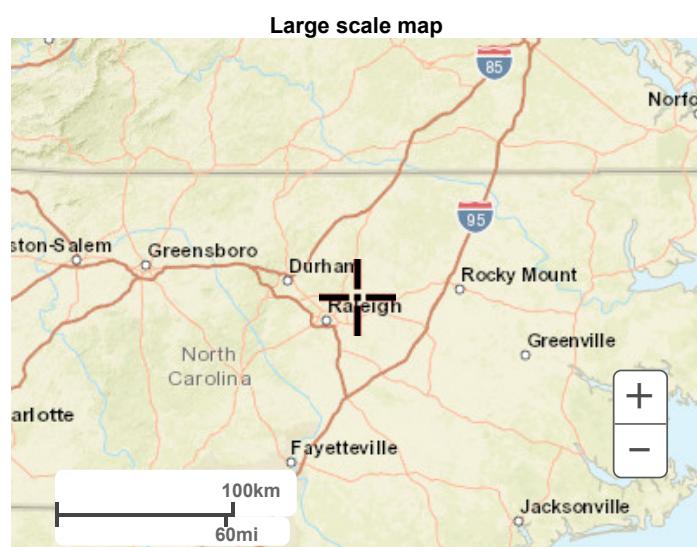
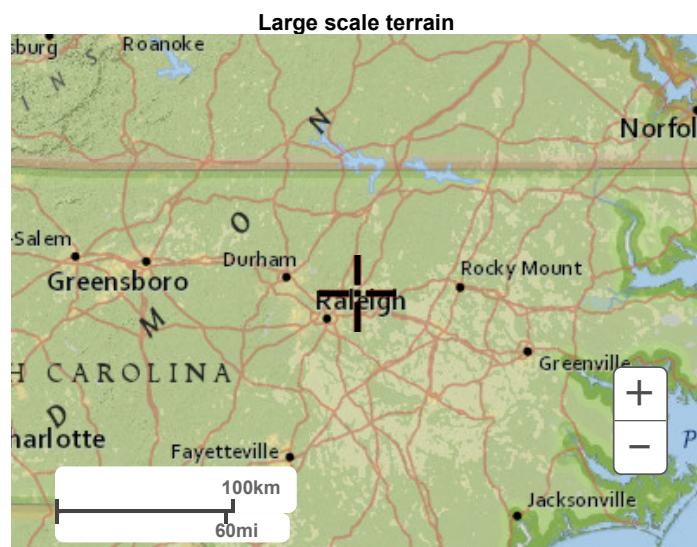
[Back to Top](#)**PF graphical**

PDS-based depth-duration-frequency (DDF) curves  
Latitude: 35.9053°, Longitude: -78.4520°

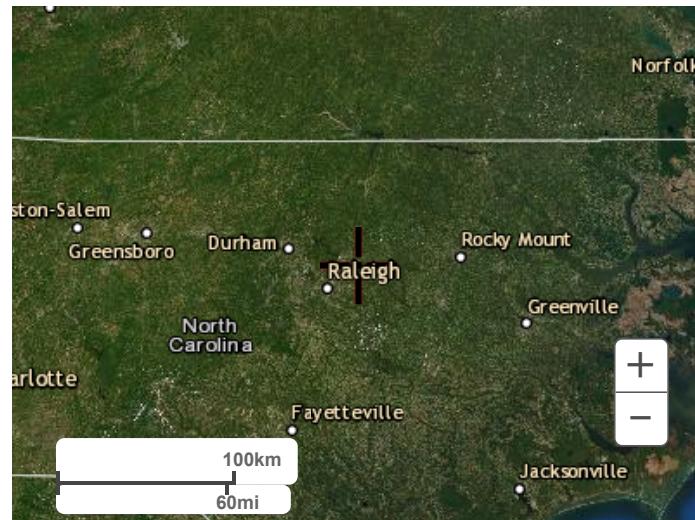


## Maps & aerials

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Large scale aerial



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*PRE-DEVELOPMENT  
HYDROLOGIC CALCULATIONS*

The Point  
AWH-20000

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Total Area (ac)
Crops	B	78	Yes	0	0.00	23.79
Crops	B/D	89	Yes	0	0.00	0.13
Crops	D	89	Yes	0	0.00	6.70
Low Density Residential	B	68		20	0.06	0.29
Low Density Residential	D	84		20	4.53	22.63
Medium Density Residential	B	70		25	0.29	1.14
Medium Density Residential	D	85		25	0.02	0.08
Mixed Use Neighborhood	B	85		65	9.26	14.25
Mixed Use Neighborhood	B/D	92		65	2.68	4.12
Mixed Use Neighborhood	C	90		65	1.16	1.79
Mixed Use Neighborhood	D	92		65	10.60	16.30
Open	B	61	Yes	0	0.00	16.63
Open	B/D	80	Yes	0	0.00	0.38
Open	D	80	Yes	0	0.00	8.88
Pond	B	100	Yes	0	0.00	0.13
Pond	B/D	100	Yes	0	0.00	0.02
Pond	D	100	Yes	0	0.00	6.78
Roadway		98		100	7.98	7.98
Roof	B	98	Yes	100	0.35	0.35
Roof	D	98	Yes	100	0.00	0.00
School	B	88		72	12.90	17.91
School	B/D	93		72	6.11	8.49
School	D	93		72	43.84	60.89
Trail	B	82	Yes	100	0.52	0.52
Trail	B/D	89	Yes	100	0.01	0.01
Trail	D	89	Yes	100	0.11	0.11
Wooded	B	55	Yes	0	0.00	8.52
Wooded	B/D	77	Yes	0	0.00	6.40
Wooded	C	70	Yes	0	0.00	0.03
Wooded	D	77	Yes	0	0.00	1.61
<b>Total Area</b>		<b>236.88 ac</b>				
<b>Total Impervious Area</b>		<b>100.42 ac</b>				
<b>Onsite Area</b>		<b>81.00 ac</b>				
<b>Onsite Impervious Area</b>		<b>0.99 ac</b>				
<b>Percent Impervious</b>		<b>42 %</b>				
<b>Composite Curve Number</b>		<b>89</b>				

**Time of Concentration Information**

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

**Segment 1: Overland Flow**

Length =	100	ft
Top Elev =	426.00	ft
Bot Elev =	425.00	ft
Height =	1	ft
Slope =	0.0100	ft/ft
Manning's n =	0.17	cultivated soils, residue cover
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
<b>Segment Time =</b>	<b>13.74</b>	<b>minutes</b>

**Segment 2: Concentrated Flow**

Length =	2645	ft
Top Elev =	425.00	ft
Bot Elev =	374.00	ft
Height =	51	ft
Slope =	0.0193	ft/ft
Paved ? =	No	
Velocity =	2.24	ft/sec
<b>Segment Time =</b>	<b>19.68</b>	<b>minutes</b>

**Segment 3: Open Water Flow**

Length =	580	ft
Top Elev =	374.00	ft
Bot Elev =	372.00	ft
<b>Segment Time =</b>	<b>0.00</b>	<b>minutes</b>

**Segment 4: Channel Flow**

Length =	2088	ft
Top Elev =	372.00	ft
Bot Elev =	344.00	ft
Height =	28	ft
Slope =	0.0134	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	15.00	sf (assume 5'w x 3'h channel)
Wetted Perimeter =	11.00	lf (assume 5'w x 3'h channel)
Channel Velocity =	4.72	ft/sec
<b>Segment Time =</b>	<b>7.38</b>	<b>minutes</b>

<b>Time of Concentration =</b>	<b>40.80</b>	<b>minutes</b>
<b>SCS Lag Time =</b>	<b>24.48</b>	<b>minutes (SCS Lag = 0.6 * Tc)</b>
<b>Time Increment =</b>	<b>7.10</b>	<b>minutes (= 0.29 * SCS Lag)</b>

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Area (ac)
Crops	B	78	Yes	0	0.00	1.34
Crops	D	89	Yes	0	0.00	0.55
Low Density Residential	D	84		20	3.59	17.96
Mixed Use Neighborhood	B	85		65	3.44	5.30
Mixed Use Neighborhood	B/D	92		65	0.58	0.89
Mixed Use Neighborhood	D	92		65	8.11	12.48
Open	B	61	Yes	0	0.00	0.92
Open	D	80	Yes	0	0.00	0.75
Roadway		98		100	13.35	13.35
Trail	B	82	Yes	100	0.07	0.07
Trail	D	89	Yes	100	0.22	0.22
Wooded	B	55	Yes	0	0.00	2.53
Wooded	B/D	77	Yes	0	0.00	1.21
Wooded	D	77	Yes	0	0.00	2.33

Total Area	<b>59.90 ac</b>
Total Impervious Area	<b>29.36 ac</b>
Onsite Area	<b>9.92 ac</b>
Onsite Impervious Area	<b>0.28 ac</b>
Percent Impervious	<b>49 %</b>
Composite Curve Number	<b>87</b>

#### Time of Concentration Information

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

##### **Segment 1: Overland Flow**

Length = 100 ft  
 Top Elev = 427.00 ft  
 Bot Elev = 426.00 ft  
 Height = 1 ft  
 Slope = 0.0100 ft/ft  
 Manning's n = 0.17 cultivated soils, residue cover  
 P (2-year/24-hour) = 3.46 inches (Rolesville, NC)  
**Segment Time = 13.74 minutes**

##### **Segment 2: Concentrated Flow**

Length = 2541 ft  
 Top Elev = 426.00 ft  
 Bot Elev = 368.00 ft  
 Height = 58 ft  
 Slope = 0.0228 ft/ft  
 Paved ? = No  
 Velocity = 2.44 ft/sec  
**Segment Time = 17.37 minutes**

Time of Concentration =	31.12	minutes
SCS Lag Time =	18.67	minutes (SCS Lag = 0.6 * Tc)
Time Increment =	5.41	minutes (= 0.29 * SCS Lag)

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Area (ac)
Open	C	74	Yes	0	0.00	1.23
Open	D	80	Yes	0	0.00	1.45
Wooded	C	70	Yes	0	0.00	0.85
Wooded	D	77	Yes	0	0.00	4.59
<b>Total Area</b>		<b>8.11 ac</b>				
<b>Total Impervious Area</b>		<b>0.00 ac</b>				
<b>Onsite Area</b>		<b>8.11 ac</b>				
<b>Onsite Impervious Area</b>		<b>0.00 ac</b>				
<b>Percent Impervious</b>		<b>0 %</b>				
<b>Composite Curve Number</b>		<b>76</b>				

#### Time of Concentration Information

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

##### **Segment 1: Overland Flow**

Length =	100	ft
Top Elev =	368.00	ft
Bot Elev =	363.00	ft
Height =	5	ft
Slope =	0.0500	ft/ft
Manning's n =	0.24	dense grasses
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
<b>Segment Time =</b>	<b>9.51</b>	<b>minutes</b>

##### **Segment 2: Concentrated Flow**

Length =	881	ft
Top Elev =	363.00	ft
Bot Elev =	336.00	ft
Height =	27	ft
Slope =	0.0306	ft/ft
Paved ? =	No	
Velocity =	2.82	ft/sec
<b>Segment Time =</b>	<b>5.20</b>	<b>minutes</b>

##### **Segment 3: Channel Flow**

Length =	249	ft
Top Elev =	336.00	ft
Bot Elev =	333.00	ft
Height =	3	ft
Slope =	0.0120	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	15.00	sf (assume 5'w x 3'h channel)
Wetted Perimeter =	11.00	lf (assume 5'w x 3'h channel)
Channel Velocity =	4.47	ft/sec
<b>Segment Time =</b>	<b>0.93</b>	<b>minutes</b>

<b>Time of Concentration =</b>	<b>15.64</b>	<b>minutes</b>
<b>SCS Lag Time =</b>	<b>9.38</b>	<b>minutes (SCS Lag = 0.6* Tc)</b>
<b>Time Increment =</b>	<b>2.72</b>	<b>minutes (= 0.29*SCS Lag)</b>

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Area (ac)
Crops	B	78	Yes	0	0.00	6.35
Crops	B/D	89	Yes	0	0.00	0.16
Crops	D	89	Yes	0	0.00	3.19
Mixed Use Neighborhood	B	85		65	1.18	1.82
Mixed Use Neighborhood	B/D	92		65	0.56	0.86
Mixed Use Neighborhood	C	90		65	0.68	1.04
Mixed Use Neighborhood	D	92		65	5.08	7.81
Open	A	39	Yes	0	0.00	1.44
Open	B	61	Yes	0	0.00	10.63
Open	B/D	80	Yes	0	0.00	8.78
Open	C	74	Yes	0	0.00	4.91
Open	D	80	Yes	0	0.00	20.40
Roadway		98		100	7.47	7.47
Roof	B	98	Yes	100	0.11	0.11
Roof	B/D	98	Yes	100	0.00	0.00
Roof	D	98	Yes	100	0.03	0.03
Trail	A	72	Yes	100	0.17	0.17
Trail	B	82	Yes	100	0.39	0.39
Trail	B/D	89	Yes	100	0.19	0.19
Trail	D	89	Yes	100	0.69	0.69
Wooded	A	30	Yes	0	0.00	0.00
Wooded	B	55	Yes	0	0.00	3.07
Wooded	B/D	77	Yes	0	0.00	9.47
Wooded	C	70	Yes	0	0.00	7.15
Wooded	D	77	Yes	0	0.00	12.43
<b>Total Area</b>		<b>108.57 ac</b>				
<b>Total Impervious Area</b>		<b>16.56 ac</b>				
<b>Onsite Area</b>		<b>89.56 ac</b>				
<b>Onsite Impervious Area</b>		<b>1.59 ac</b>				
<b>Percent Impervious</b>		<b>15 %</b>				
<b>Composite Curve Number</b>		<b>78</b>				

**Time of Concentration Information**

*Time of concentration is calculated using the SCS Segmental Approach (TR-55).*

**Segment 1: Overland Flow**

Length =	100	ft
Top Elev =	389.00	ft
Bot Elev =	388.00	ft
Height =	1	ft
Slope =	0.0100	ft/ft
Manning's n =	0.17	cultivated soils, residue cover
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
<b>Segment Time =</b>	<b>13.74</b>	<b>minutes</b>

**Segment 2: Concentrated Flow**

Length =	1855	ft
Top Elev =	388.00	ft
Bot Elev =	339.00	ft
Height =	49	ft
Slope =	0.0264	ft/ft
Paved ? =	No	
Velocity =	2.62	ft/sec
<b>Segment Time =</b>	<b>11.79</b>	<b>minutes</b>

**Segment 3: Channel Flow**

Length =	2366	ft
Top Elev =	339.00	ft
Bot Elev =	302.00	ft
Height =	37	ft
Slope =	0.0156	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	15.00	sf (assume 5'w x 3'h channel)
Wetted Perimeter =	11.00	lf (assume 5'w x 3'h channel)
Channel Velocity =	5.09	ft/sec
<b>Segment Time =</b>	<b>7.74</b>	<b>minutes</b>

<b>Time of Concentration =</b>	33.28	minutes
<b>SCS Lag Time =</b>	19.97	minutes (SCS Lag = 0.6* Tc)
<b>Time Increment =</b>	5.79	minutes (= 0.29*SCS Lag)

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Area (ac)
Business Park	A	89		85	0.01	0.01
Business Park	B	92		85	0.02	0.02
Business Park	D	95		85	0.03	0.03
Commercial	D	95		85	0.86	1.01
High Density Residential	B	85		65	46.03	70.82
High Density Residential	D	92		65	33.44	51.45
Low Density Residential	B	65		20	0.18	0.92
Low Density Residential	D	82		20	0.37	1.85
Medium Density Residential	A	54		25	0.00	0.01
Medium Density Residential	B	70		25	11.98	47.92
Medium Density Residential	D	85		25	10.74	42.98
Mixed Use Neighborhood	B	85		65	4.36	6.71
Mixed Use Neighborhood	B/D	92		65	2.15	3.31
Mixed Use Neighborhood	D	92		65	7.50	11.55
Open	A	49	Yes	0	0.00	1.90
Open	B	69	Yes	0	0.00	10.33
Open	D	84	Yes	0	0.00	11.86
Preserved Open Space	A	39		0	0.00	0.39
Preserved Open Space	B	61		0	0.00	4.48
Preserved Open Space	D	80		0	0.00	34.05
Roadway		98		100	49.05	49.05
School	B	88		72	0.34	0.47
School	D	93		72	5.12	7.11
Town Center	B	92		85	5.55	6.53
Town Center	D	95		85	1.48	1.74
Trail	A	72	Yes	100	0.02	0.02
Trail	B	82	Yes	100	0.43	0.43
Trail	D	89	Yes	100	1.93	1.93
Wooded	A	30	Yes	0	0.00	0.70
Wooded	B	55	Yes	0	0.00	4.50
Wooded	B/D	77	Yes	0	0.00	0.15
Wooded	D	77	Yes	0	0.00	50.68
Total Area		424.89 ac				
Total Impervious Area		181.60 ac				
Onsite Area		82.49 ac				
Onsite Impervious Area		2.38 ac				
Percent Impervious		43 %				
Composite Curve Number		84				

Time of Concentration Information

*Time of concentration is calculated using the SCS Segmental Approach (TR-55).*

*Segment 1: Overland Flow*

Length =	100	ft
Top Elev =	440.00	ft
Bot Elev =	438.00	ft
Height =	2	ft
Slope =	0.0200	ft/ft
Manning's n =	0.24	dense grasses
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
<i>Segment Time =</i>	<b>13.72</b>	<i>minutes</i>

*Segment 2: Concentrated Flow*

Length =	2989	ft
Top Elev =	438.00	ft
Bot Elev =	372.00	ft
Height =	66	ft
Slope =	0.0221	ft/ft
Paved ? =	No	
Velocity =	2.40	ft/sec
<i>Segment Time =</i>	<b>20.78</b>	<i>minutes</i>

*Segment 3: Open Water Flow*

Length =	655	ft
Top Elev =	372.00	ft
Bot Elev =	372.00	ft
<i>Segment Time =</i>	<b>0.00</b>	<i>minutes</i>

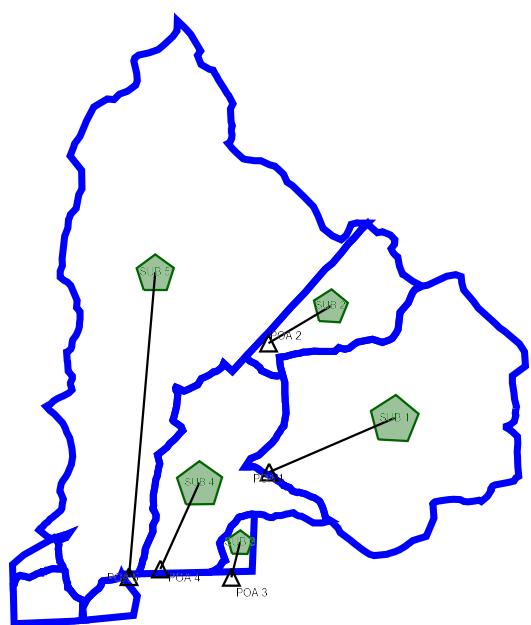
*Segment 4: Concentrated Flow*

Length =	2379	ft
Top Elev =	372.00	ft
Bot Elev =	320.00	ft
Height =	52	ft
Slope =	0.0219	ft/ft
Paved ? =	No	
Velocity =	2.39	ft/sec
<i>Segment Time =</i>	<b>16.62</b>	<i>minutes</i>

*Segment 5: Channel Flow*

Length =	3730	ft
Top Elev =	320.00	ft
Bot Elev =	292.00	ft
Height =	28	ft
Slope =	0.0075	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	32.00	sf (assume 8'w x 4'h channel)
Wetted Perimeter =	16.00	lf (assume 8'w x 4'h channel)
Channel Velocity =	4.55	ft/sec
<i>Segment Time =</i>	<b>13.65</b>	<i>minutes</i>

Time of Concentration =	64.78	minutes
SCS Lag Time =	38.87	minutes (SCS Lag = 0.6 * Tc)
Time Increment =	11.27	minutes (= 0.29 * SCS Lag)

**Scenario: Pre-  
Development**



FlexTable: Catchment  
Table (AWH20000-  
CDPackage2.ppc)

Current Time: 0.00 min

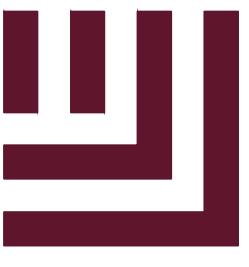
Label	Area (acres)	SCS CN	Time of Concentration (min)		Notes
			89	40.80	
SUB 1	236.88		89	40.80	PRE
SUB 2	59.90		87	31.12	PRE
SUB 4	108.57		78	33.28	PRE
SUB5	424.89		84	64.78	PRE
SUB 3	8.11		76	15.64	PRE

### Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft³/s)
SUB 1	Pre-Dev 1 yr	1	34.657	745.00	283.5
SUB 1	Pre-Dev 10 yr	10	74.868	745.00	545.3
SUB 1	Pre-Dev 25 yr	25	93.042	745.00	645.2
SUB 2	Pre-Dev 1 yr	1	8.007	739.00	77.3
SUB 2	Pre-Dev 10 yr	10	17.950	738.00	153.0
SUB 2	Pre-Dev 25 yr	25	22.487	738.00	181.6
SUB 4	Pre-Dev 1 yr	1	9.218	741.00	80.9
SUB 4	Pre-Dev 10 yr	10	24.755	741.00	204.9
SUB 4	Pre-Dev 25 yr	25	32.262	741.00	255.8
SUB5	Pre-Dev 1 yr	1	48.718	760.00	297.7
SUB5	Pre-Dev 10 yr	10	115.774	760.00	664.9
SUB5	Pre-Dev 25 yr	25	147.000	760.00	815.4
SUB 3	Pre-Dev 1 yr	1	0.620	730.00	8.2
SUB 3	Pre-Dev 10 yr	10	1.739	728.00	21.2
SUB 3	Pre-Dev 25 yr	25	2.287	728.00	26.4

### Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft³/s)
POA 4	Pre-Dev 1 yr	1	43.741	757.00	344.2
POA 4	Pre-Dev 10 yr	10	99.357	752.00	704.1
POA 4	Pre-Dev 25 yr	25	125.001	752.00	846.2
POA 2	Pre-Dev 1 yr	1	8.007	739.00	77.3
POA 2	Pre-Dev 10 yr	10	17.950	738.00	153.0
POA 2	Pre-Dev 25 yr	25	22.487	738.00	181.6
POA 1	Pre-Dev 1 yr	1	34.657	745.00	283.5
POA 1	Pre-Dev 10 yr	10	74.868	745.00	545.3
POA 1	Pre-Dev 25 yr	25	93.042	745.00	645.2
POA 5	Pre-Dev 1 yr	1	48.718	760.00	297.7
POA 5	Pre-Dev 10 yr	10	115.774	760.00	664.9
POA 5	Pre-Dev 25 yr	25	147.000	760.00	815.4
POA 3	Pre-Dev 1 yr	1	0.620	730.00	8.2
POA 3	Pre-Dev 10 yr	10	1.739	728.00	21.2
POA 3	Pre-Dev 25 yr	25	2.287	728.00	26.4



# McADAMS

The John R. McAdams Company, Inc.  
2905 Meridian Parkway  
Durham, NC 27713

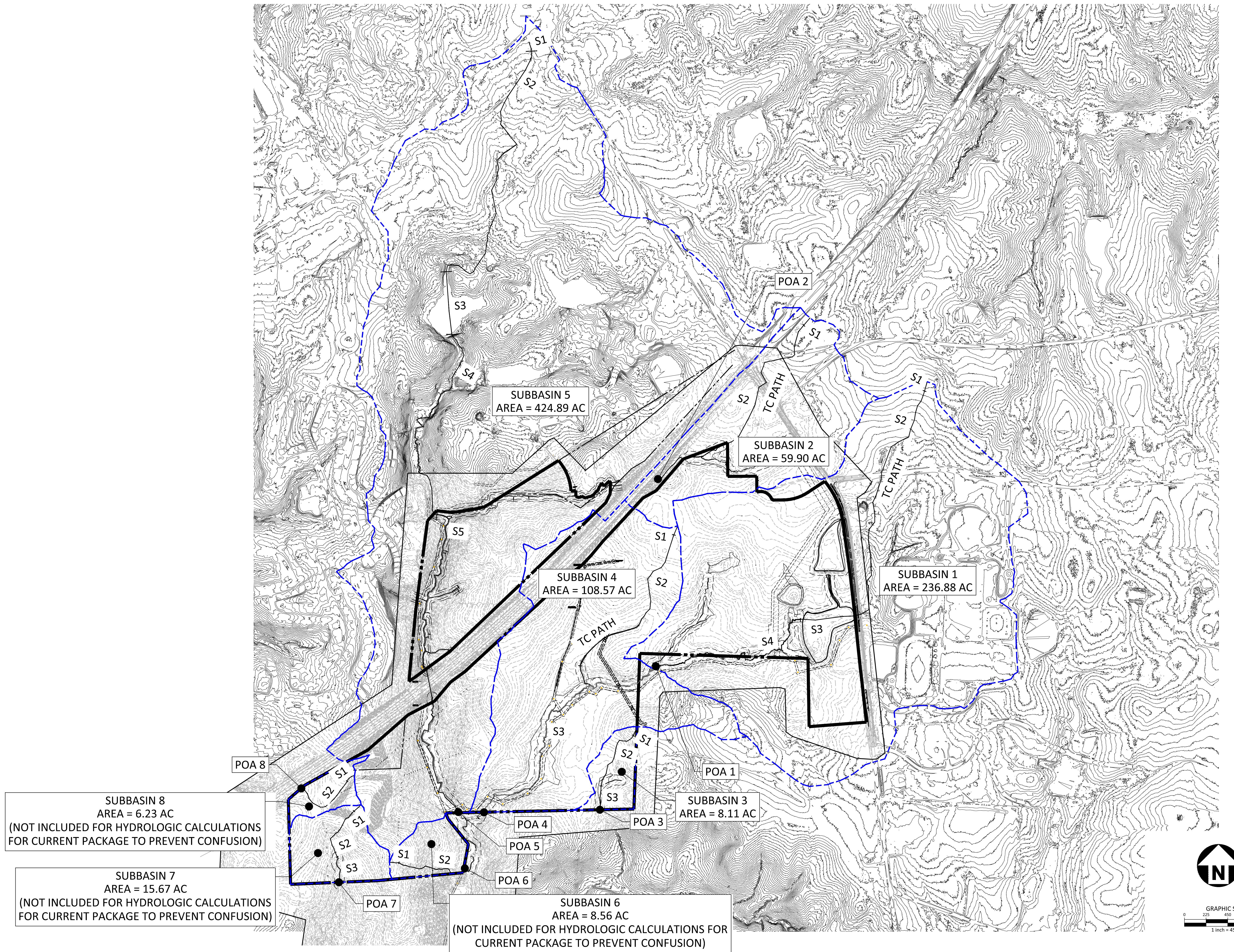
phone 919. 361. 5000  
fax 919. 361. 2269  
nse number: C-0293, C-187

IENT  
HTON RALEIGH RESIDENTIAL, LLC.  
1 SIX FORKS ROAD, SUITE 300  
LEIGH, NORTH CAROLINA 27609  
ONE: 919. 232. 3695  
NTACT: BOB MISHLER



# **THE POINT PHASES 1-10 AND 14 PRELIMINARY PLAT PLANS EAST YOUNG STREET TOWN OF ROLESVILLE, WAKE FOREST TOWNSHIP WAKE COUNTY, NORTH CAROLINA**

TOWN OF RULESVILLE, WAKE FOREST TOWNSHIP,  
WAKE COUNTY, NORTH CAROLINA



## REVISIONS

NO.	DATE	REV PER TOWN COMMENTS
1	04. 09. 2020	REV PER TOWN COMMENTS
2	06. 19. 2020	REV PER MUNICIPAL COMMENTS
3	08. 31. 2020	REV PER MUNICIPAL COMMENTS

## PLAN INFORMATION

PROJECT NO. AWH-20000  
FILENAME AWH-20000 PRE  
CHECKED BY DCW  
DRAWN BY TKD  
SCALE 1" = 450'  
DATE 08.12.2021

# SHEET

## RE DEVELOPMENT

## PRE-DEVELOPMENT HYDROLOGY MAP

# PRE

RELIMINARY DRAWING - NOT RELEASED FOR CONSTRUCTION

*POST-DEVELOPMENT  
HYDROLOGIC CALCULATIONS*

The Point  
AWH-20000

**I. ONSITE SCS CURVE NUMBERS - LAND COVER**

HSG	Open	Wooded	Roads	Sidewalk	Pond	Crops
A	39	30	98	98	100	67
B	61	55	98	98	100	78
B/D	80	77	98	98	100	89
C	74	70	98	98	100	85
D	80	77	98	98	100	89

BasinID: 0

**II. ONSITE SCS CURVE NUMBERS - LOTS**

HSG	22' Townhome	39' Single Family	40' Single Family	50' Single Family	60' Single Family
A	93	77	76	74	69
B	95	85	84	83	80
B/D	96	92	91	91	89
C	96	90	89	88	86
D	96	92	91	91	89

**III. OFFSITE SCS CURVE NUMBERS - ZONING**

HSG	Right-Of-Way	Zoning - High Res (1/3 acre)	Zoning - Med Res (1/2 acre)	Zoning - Low Res (1 acre)	Zoning - Commercial	Zoning - MU Neighborhood	Zoning - Business Park	Zoning - Preserved Open	Town Center	School
A	83	57	54	51	89	72	89	39	89	75
B	89	72	70	68	92	85	92	61	92	88
B/D	93	86	85	84	95	92	95	80	95	93
C	91	82	80	79	94	90	94	74	94	91
D	93	86	85	84	95	92	95	80	95	93

**IV. ONSITE AREAS - LAND COVER**

HSG	Open	Onsite Wooded	Onsite Roads	Onsite Sidewalk	Pond	Onsite Crops
A	0	0	0	0	0	0
B	90833	0	86247	24577	11367	4630
B/D	0	0	0	0	0	0
C	0	0	0	0	0	0
D	72662	0	26709	8971	0	9

**V. ONSITE AREAS - LOTS**

HSG	Townhome22	SingleFamily39	SingleFamily40	SingleFamily50	SingleFamily60
A	0	0	0	0	0
B	0	0	84208	0	23114
B/D	0	0	0	0	0
C	0	0	0	0	0
D	0	0	6862	0	0

**VI. OFFSITE AREAS - ZONING**

HSG	90% impervious	30% impervious	25% impervious	20% impervious	85% impervious	65% impervious	85% impervious	0% impervious	85% impervious	72% impervious
	Right of Way	High Density Residential	Medium Density Residential	Low Density Residential	Commercial	Mixed Use Neighborhood	Business Park	Preserved Open Space	Town Center	School
A	0	0	0	0	0	0	0	0	0	0
B	0	0	0	0	0	0	0	0	0	0
B/D	0	0	0	0	0	0	0	0	0	0
C	0	0	0	0	0	0	0	0	0	0
D	186	0	0	0	0	78952	0	0	0	0

**VII. LOT BREAKDOWN**

Contributing Area	Total Impervious [sf]	Roof Area [sf] (70%)	Sidewalk Area [sf] (10%)	Driveway Area [sf] (20%)
Townhome22	0	0	0	0
SingleFamily39	0	0	0	0
SingleFamily40	56,464	39,525	5,646	11,293
SingleFamily50	0	0	0	0
SingleFamily60	11,557	8,090	1,156	2,311
<i>Totals</i>	68,021	47,614	6,802	13,604

**VIII. TOTAL DRAINAGE AREA RESULT**

Total Area per GIS Calc = 11.92 acres  
**519328** sf

Composite SCS CN = 85  
Total Impervious Area = **266011** sf

% Impervious = 51.2%

**IX. TIME OF CONCENTRATION**

*Time of concentration is assumed to be 5 minutes.*

Time of Concentration =	5.00	minutes
SCS Lag Time =	3.00	minutes (SCS Lag = 0.6 * Tc)
Time Increment =	0.87	minutes (= 0.29 * SCS Lag)

**I. ONSITE SCS CURVE NUMBERS - LAND COVER**

HSG	Open	Wooded	Roads	Sidewalk	Pond	Crops
A	39	30	98	98	100	67
B	61	55	98	98	100	78
B/D	80	77	98	98	100	89
C	74	70	98	98	100	85
D	80	77	98	98	100	89

BasinID: **12**

**II. ONSITE SCS CURVE NUMBERS - LOTS**

HSG	22' Townhome	39' Single Family	40' Single Family	50' Single Family	60' Single Family
A	93	77	76	74	69
B	95	85	84	83	80
B/D	96	92	91	91	89
C	96	90	89	88	86
D	96	92	91	91	89

**III. OFFSITE SCS CURVE NUMBERS - ZONING**

HSG	Right-Of-Way	Zoning - High Res (1/3 acre)	Zoning - Med Res (1/2 acre)	Zoning - Low Res (1 acre)	Zoning - Commercial	Zoning - MU Neighborhood	Zoning - Business Park	Zoning - Preserved Open	Town Center	School
A	83	57	54	51	89	72	89	39	89	75
B	89	72	70	68	92	85	92	61	92	88
B/D	93	86	85	84	95	92	95	80	95	93
C	91	82	80	79	94	90	94	74	94	91
D	93	86	85	84	95	92	95	80	95	93

**IV. ONSITE AREAS - LAND COVER**

HSG	Open	Onsite Wooded	Onsite Roads	Onsite Sidewalk	Pond	Onsite Crops
A	0	0	0	0	0	0
B	71700	0	28982	8643	5484	0
B/D	0	0	0	0	0	0
C	0	0	0	0	0	0
D	58586	0	39271	10383	3169	0

**V. ONSITE AREAS - LOTS**

HSG	Townhome22	SingleFamily39	SingleFamily40	SingleFamily50	SingleFamily60
A	0	0	0	0	0
B	67910	0	0	0	0
B/D	0	0	0	0	0
C	0	0	0	0	0
D	66566	0	0	0	0

**VI. OFFSITE AREAS - ZONING**

HSG	90% impervious	30% impervious	25% impervious	20% impervious	85% impervious	65% impervious	85% impervious	0% impervious	85% impervious	72% impervious
	Right of Way	High Density Residential	Medium Density Residential	Low Density Residential	Commercial	Mixed Use Neighborhood	Business Park	Preserved Open Space	Town Center	School
A	0	0	0	0	0	0	0	0	0	0
B	1697	0	0	0	0	70164	0	0	0	0
B/D	0	0	0	0	0	0	0	0	0	0
C	0	0	0	0	0	0	0	0	0	0
D	559	0	0	0	0	13932	0	0	0	0

**VII. LOT BREAKDOWN**

Contributing Area	Total Impervious [sf]	Roof Area [sf] (70%)	Sidewalk Area [sf] (10%)	Driveway Area [sf] (20%)
Townhome22	122,251	85,576	12,225	24,450
SingleFamily39	0	0	0	0
SingleFamily40	0	0	0	0
SingleFamily50	0	0	0	0
SingleFamily60	0	0	0	0
<i>Totals</i>	122,251	85,576	12,225	24,450

**VIII. TOTAL DRAINAGE AREA RESULT**

Total Area per GIS Calc = 10.26 acres  
**447048** sf

Composite SCS CN = 87

Total Impervious Area = 266224 sf

% Impervious = 59.6%

**IX. TIME OF CONCENTRATION**

*Time of concentration is assumed to be 5 minutes.*

Time of Concentration =	5.00	minutes
SCS Lag Time =	3.00	minutes (SCS Lag = 0.6 * Tc)
Time Increment =	0.87	minutes (= 0.29 * SCS Lag)

## I. ONSITE SCS CURVE NUMBERS - LAND COVER

HSG	Open	Wooded	Roads	Sidewalk	Pond	Crops
A	39	30	98	98	100	67
B	61	55	98	98	100	78
B/D	80	77	98	98	100	89
C	74	70	98	98	100	85
D	80	77	98	98	100	89

BasinID: 1

## **II. ONSITE SCS CURVE NUMBERS - LOTS**

HSG	22' Townhome	39' Single Family	40' Single Family	50' Single Family	60' Single Family
A	93	77	76	74	69
B	95	85	84	83	80
B/D	96	92	91	91	89
C	96	90	89	88	86
D	96	92	91	91	89

### III. OFFSITE SCS CURVE NUMBERS - ZONING

HSG	Right-Of-Way	Zoning - High Res (1/3 acre)	Zoning - Med Res (1/2 acre)	Zoning - Low Res (1 acre)	Zoning - Commercial	Zoning - MU Neighborhood	Zoning - Business Park	Zoning - Preserved Open	Town Center	School
A	83	57	54	51	89	72	89	39	89	75
B	89	72	70	68	92	85	92	61	92	88
B/D	93	86	85	84	95	92	95	80	95	93
C	91	82	80	79	94	90	94	74	94	91
D	93	86	85	84	95	92	95	80	95	93

#### **IV. ONSITE AREAS - LAND COVER**

HSG	Open	Onsite Wooded	Onsite Roads	Onsite Sidewalk	Pond	Onsite Crops
A	0	0	0	0	0	0
B	61769	0	73235	21972	1330	804
B/D	0	0	0	0	0	0
C	0	0	0	0	0	0
D	51459	0	40559	12919	13788	88

V. ONSITE AREAS - LOTS

HSG	Townhome22	SingleFamily39	SingleFamily40	SingleFamily50	SingleFamily60
A	0	0	0	0	0
B	0	90183	141800	0	43514
B/D	0	0	0	0	0
C	0	0	0	0	0
D	0	79639	39449	0	10628

## **VI OFFSITE AREAS - ZONING**

**VII. LOT BREAKDOWN**

Contributing Area	Total Impervious [sf]	Roof Area [sf] (70%)	Sidewalk Area [sf] (10%)	Driveway Area [sf] (20%)
Townhome22	0	0	0	0
SingleFamily39	109,806	76,864	10,981	21,961
SingleFamily40	112,374	78,662	11,237	22,475
SingleFamily50	0	0	0	0
SingleFamily60	27,071	18,950	2,707	5,414
<i>Totals</i>	<b>249,251</b>	174,476	24,925	49,850

**VIII. TOTAL DRAINAGE AREA RESULT**

Total Area per GIS Calc = 15.68 acres  
**683134** sf

Composite SCS CN = 86

Total Impervious Area = 397936 sf

% Impervious = 58.3%

**IX. TIME OF CONCENTRATION**

*Time of concentration is assumed to be 5 minutes.*

Time of Concentration =	5.00	minutes
SCS Lag Time =	3.00	minutes (SCS Lag = 0.6 * Tc)
Time Increment =	0.87	minutes (= 0.29 * SCS Lag)

## I. ONSITE SCS CURVE NUMBERS - LAND COVER

HSG	Open	Wooded	Roads	Sidewalk	Pond	Crops
A	39	30	98	98	100	67
B	61	55	98	98	100	78
B/D	80	77	98	98	100	89
C	74	70	98	98	100	85
D	80	77	98	98	100	89

BasinID: 1

## **II. ONSITE SCS CURVE NUMBERS - LOTS**

HSG	22' Townhome	39' Single Family	40' Single Family	50' Single Family	60' Single Family
A	93	77	76	74	69
B	95	85	84	83	80
B/D	96	92	91	91	89
C	96	90	89	88	86
D	96	92	91	91	89

### III. OFFSITE SCS CURVE NUMBERS - ZONING

HSG	Right-Of-Way	Zoning - High Res (1/3 acre)	Zoning - Med Res (1/2 acre)	Zoning - Low Res (1 acre)	Zoning - Commercial	Zoning - MU Neighborhood	Zoning - Business Park	Zoning - Preserved Open	Town Center	School
A	83	57	54	51	89	72	89	39	89	75
B	89	72	70	68	92	85	92	61	92	88
B/D	93	86	85	84	95	92	95	80	95	93
C	91	82	80	79	94	90	94	74	94	91
D	93	86	85	84	95	92	95	80	95	93

#### **IV. ONSITE AREAS - LAND COVER**

HSG	Open	Onsite Wooded	Onsite Roads	Onsite Sidewalk	Pond	Onsite Crops
A	0	0	0	0	0	0
B	45141	0	59630	16037	8728	1677
B/D	5822	0	3836	1966	0	0
C	0	0	0	0	0	0
D	45560	0	60659	16233	15434	3379

V. ONSITE AREAS - LOTS

HSG	Townhome22	SingleFamily39	SingleFamily40	SingleFamily50	SingleFamily60
A	0	0	0	0	0
B	0	57697	98197	0	86974
B/D	0	0	1650	0	22691
C	0	0	0	0	0
D	0	49507	101286	0	55579

#### **VI OFFSITE AREAS - ZONING**

**VII. LOT BREAKDOWN**

Contributing Area	Total Impervious [sf]	Roof Area [sf] (70%)	Sidewalk Area [sf] (10%)	Driveway Area [sf] (20%)
Townhome22	0	0	0	0
SingleFamily39	69,318	48,523	6,932	13,864
SingleFamily40	124,702	87,292	12,470	24,940
SingleFamily50	0	0	0	0
SingleFamily60	82,622	57,836	8,262	16,524
<i>Totals</i>	276,643	193,650	27,664	55,329

**VIII. TOTAL DRAINAGE AREA RESULT**

Total Area per GIS Calc = 17.39 acres  
**757683** sf

Composite SCS CN = 87  
Total Impervious Area = **435004** sf

% Impervious = 57.4%

**IX. TIME OF CONCENTRATION**

*Time of concentration is assumed to be 5 minutes.*

Time of Concentration =	5.00	minutes
SCS Lag Time =	3.00	minutes (SCS Lag = 0.6 * Tc)
Time Increment =	0.87	minutes (= 0.29 * SCS Lag)

## I. ONSITE SCS CURVE NUMBERS - LAND COVER

HSG	Open	Wooded	Roads	Sidewalk	Pond	Crops
A	39	30	98	98	100	67
B	61	55	98	98	100	78
B/D	80	77	98	98	100	89
C	74	70	98	98	100	85
D	80	77	98	98	100	89

BasinID: 1

## **II. ONSITE SCS CURVE NUMBERS - LOTS**

HSG	22' Townhome	39' Single Family	40' Single Family	50' Single Family	60' Single Family
A	93	77	76	74	69
B	95	85	84	83	80
B/D	96	92	91	91	89
C	96	90	89	88	86
D	96	92	91	91	89

### III. OFFSITE SCS CURVE NUMBERS - ZONING

HSG	Right-Of-Way	Zoning - High Res (1/3 acre)	Zoning - Med Res (1/2 acre)	Zoning - Low Res (1 acre)	Zoning - Commercial	Zoning - MU Neighborhood	Zoning - Business Park	Zoning - Preserved Open	Town Center	School
A	83	57	54	51	89	72	89	39	89	75
B	89	72	70	68	92	85	92	61	92	88
B/D	93	86	85	84	95	92	95	80	95	93
C	91	82	80	79	94	90	94	74	94	91
D	93	86	85	84	95	92	95	80	95	93

#### **IV. ONSITE AREAS - LAND COVER**

HSG	Open	Onsite Wooded	Onsite Roads	Onsite Sidewalk	Pond	Onsite Crops
A	0	0	0	0	0	0
B	70779	0	71986	24952	19528	0
B/D	3050	0	2654	905	85	0
C	0	0	0	0	0	0
D	487	0	383	379	0	0

V. ONSITE AREAS - LOTS

HSG	Townhome22	SingleFamily39	SingleFamily40	SingleFamily50	SingleFamily60
A	0	0	0	0	0
B	0	0	0	0	362575
B/D	0	0	0	0	17129
C	0	0	0	0	0
D	0	0	0	0	13

## **VI OFFSITE AREAS - ZONING**

**VII. LOT BREAKDOWN**

Contributing Area	Total Impervious [sf]	Roof Area [sf] (70%)	Sidewalk Area [sf] (10%)	Driveway Area [sf] (20%)
Townhome22	0	0	0	0
SingleFamily39	0	0	0	0
SingleFamily40	0	0	0	0
SingleFamily50	0	0	0	0
SingleFamily60	189,859	132,901	18,986	37,972
<i>Totals</i>	189,859	132,901	18,986	37,972

**VIII. TOTAL DRAINAGE AREA RESULT**

Total Area per GIS Calc = 13.20 acres  
**574905** sf

Composite SCS CN = 81

Total Impervious Area = **291118** sf

% Impervious = 50.6%

**IX. TIME OF CONCENTRATION**

*Time of concentration is assumed to be 5 minutes.*

Time of Concentration =	5.00	minutes
SCS Lag Time =	3.00	minutes (SCS Lag = 0.6 * Tc)
Time Increment =	0.87	minutes (= 0.29 * SCS Lag)

## I. ONSITE SCS CURVE NUMBERS - LAND COVER

HSG	Open	Wooded	Roads	Sidewalk	Pond	Crops
A	39	30	98	98	100	67
B	61	55	98	98	100	78
B/D	80	77	98	98	100	89
C	74	70	98	98	100	85
D	80	77	98	98	100	89

BasinID: 1

## **II. ONSITE SCS CURVE NUMBERS - LOTS**

HSG	22' Townhome	39' Single Family	40' Single Family	50' Single Family	60' Single Family
A	93	77	76	74	69
B	95	85	84	83	80
B/D	96	92	91	91	89
C	96	90	89	88	86
D	96	92	91	91	89

### III. OFFSITE SCS CURVE NUMBERS - ZONING

HSG	Right-Of-Way	Zoning - High Res (1/3 acre)	Zoning - Med Res (1/2 acre)	Zoning - Low Res (1 acre)	Zoning - Commercial	Zoning - MU Neighborhood	Zoning - Business Park	Zoning - Preserved Open	Town Center	School
A	83	57	54	51	89	72	89	39	89	75
B	89	72	70	68	92	85	92	61	92	88
B/D	93	86	85	84	95	92	95	80	95	93
C	91	82	80	79	94	90	94	74	94	91
D	93	86	85	84	95	92	95	80	95	93

#### **IV. ONSITE AREAS - LAND COVER**

HSG	Open	Onsite Wooded	Onsite Roads	Onsite Sidewalk	Pond	Onsite Crops
A	0	0	0	0	0	0
B	53424	0	51366	13332	0	4318
B/D	116287	0	34711	12924	47	0
C	0	0	0	0	0	0
D	65895	0	40542	13681	16065	0

## V. ONSITE AREAS - LOTS

HSG	Townhome22	SingleFamily39	SingleFamily40	SingleFamily50	SingleFamily60
A	0	0	0	0	0
B	10184	90465	85971	0	0
B/D	17316	25633	12370	0	0
C	0	0	0	0	0
D	39125	11973	73531	0	26072

## VI. OFFSITE AREAS - ZONING

**VII. LOT BREAKDOWN**

Contributing Area	Total Impervious [sf]	Roof Area [sf] (70%)	Sidewalk Area [sf] (10%)	Driveway Area [sf] (20%)
Townhome22	60,568	42,398	6,057	12,114
SingleFamily39	82,811	57,968	8,281	16,562
SingleFamily40	106,560	74,592	10,656	21,312
SingleFamily50	0	0	0	0
SingleFamily60	13,036	9,125	1,304	2,607
<i>Totals</i>	262,975	184,083	26,298	52,595

**VIII. TOTAL DRAINAGE AREA RESULT**

Total Area per GIS Calc = 18.72 acres  
**815231** sf

Composite SCS CN = 87  
Total Impervious Area = **429531** sf

% Impervious = 52.7%

**IX. TIME OF CONCENTRATION**

*Time of concentration is assumed to be 5 minutes.*

Time of Concentration =	5.00	minutes
SCS Lag Time =	3.00	minutes (SCS Lag = 0.6 * Tc)
Time Increment =	0.87	minutes (= 0.29 * SCS Lag)

## I. ONSITE SCS CURVE NUMBERS - LAND COVER

HSG	Open	Wooded	Roads	Sidewalk	Pond	Crops
A	39	30	98	98	100	67
B	61	55	98	98	100	78
B/D	80	77	98	98	100	89
C	74	70	98	98	100	85
D	80	77	98	98	100	89

BasinID: [REDACTED]

## **II. ONSITE SCS CURVE NUMBERS - LOTS**

HSG	22' Townhome	39' Single Family	40' Single Family	50' Single Family	60' Single Family
A	93	77	76	74	69
B	95	85	84	83	80
B/D	96	92	91	91	89
C	96	90	89	88	86
D	96	92	91	91	89

### III. OFFSITE SCS CURVE NUMBERS - ZONING

HSG	Right-Of-Way	Zoning - High Res (1/3 acre)	Zoning - Med Res (1/2 acre)	Zoning - Low Res (1 acre)	Zoning - Commercial	Zoning - MU Neighborhood	Zoning - Business Park	Zoning - Preserved Open	Town Center	School
A	83	57	54	51	89	72	89	39	89	75
B	89	72	70	68	92	85	92	61	92	88
B/D	93	86	85	84	95	92	95	80	95	93
C	91	82	80	79	94	90	94	74	94	91
D	93	86	85	84	95	92	95	80	95	93

#### **IV. ONSITE AREAS - LAND COVER**

HSG	Open	Onsite Wooded	Onsite Roads	Onsite Sidewalk	Pond	Onsite Crops
A	0	0	0	0	0	0
B	40011	0	31008	11259	0	0
B/D	20490	0	17445	4418	1288	0
C	0	0	0	0	0	0
D	94972	0	52042	17274	14545	0

V. ONSITE AREAS - LOTS

HSG	Townhome22	SingleFamily39	SingleFamily40	SingleFamily50	SingleFamily60
A	0	0	0	0	0
B	56568	0	0	25474	0
B/D	1586	0	0	6060	0
C	0	0	0	0	0
D	103079	0	0	97575	0

## **VI. OFFSITE AREAS - ZONING**

**VII. LOT BREAKDOWN**

Contributing Area	Total Impervious [sf]	Roof Area [sf] (70%)	Sidewalk Area [sf] (10%)	Driveway Area [sf] (20%)
Townhome22	146,576	102,603	14,658	29,315
SingleFamily39	0	0	0	0
SingleFamily40	0	0	0	0
SingleFamily50	75,576	52,903	7,558	15,115
SingleFamily60	0	0	0	0
<i>Totals</i>	222,152	155,506	22,215	44,430

**VIII. TOTAL DRAINAGE AREA RESULT**

Total Area per GIS Calc = 13.66 acres  
**595094** sf

Composite SCS CN = 90  
Total Impervious Area = **355597** sf

% Impervious = 59.8%

**IX. TIME OF CONCENTRATION**

*Time of concentration is assumed to be 5 minutes.*

Time of Concentration =	5.00	minutes
SCS Lag Time =	3.00	minutes (SCS Lag = 0.6 * Tc)
Time Increment =	0.87	minutes (= 0.29 * SCS Lag)

## I. ONSITE SCS CURVE NUMBERS - LAND COVER

HSG	Open	Wooded	Roads	Sidewalk	Pond	Crops
A	39	30	98	98	100	67
B	61	55	98	98	100	78
B/D	80	77	98	98	100	89
C	74	70	98	98	100	85
D	80	77	98	98	100	89

BasinID: [REDACTED]

## **II. ONSITE SCS CURVE NUMBERS - LOTS**

HSG	22' Townhome	39' Single Family	40' Single Family	50' Single Family	60' Single Family
A	93	77	76	74	69
B	95	85	84	83	80
B/D	96	92	91	91	89
C	96	90	89	88	86
D	96	92	91	91	89

### III. OFFSITE SCS CURVE NUMBERS - ZONING

HSG	Right-Of-Way	Zoning - High Res (1/3 acre)	Zoning - Med Res (1/2 acre)	Zoning - Low Res (1 acre)	Zoning - Commercial	Zoning - MU Neighborhood	Zoning - Business Park	Zoning - Preserved Open	Town Center	School
A	83	57	54	51	89	72	89	39	89	75
B	89	72	70	68	92	85	92	61	92	88
B/D	93	86	85	84	95	92	95	80	95	93
C	91	82	80	79	94	90	94	74	94	91
D	93	86	85	84	95	92	95	80	95	93

#### **IV. ONSITE AREAS - LAND COVER**

HSG	Open	Onsite Wooded	Onsite Roads	Onsite Sidewalk	Pond	Onsite Crops
A	0	0	0	0	0	0
B	0	0	0	0	0	0
B/D	9097	0	12526	3521	0	0
C	41860	73	56870	17719	0	0
D	47299	9384	30675	8063	17405	0

V. ONSITE AREAS - LOTS

HSG	Townhome22	SingleFamily39	SingleFamily40	SingleFamily50	SingleFamily60
A	0	0	0	0	0
B	0	0	0	0	0
B/D	0	0	0	17962	0
C	0	0	0	336018	0
D	0	0	0	106065	0

## **VI. OFFSITE AREAS - ZONING**

**VII. LOT BREAKDOWN**

Contributing Area	Total Impervious [sf]	Roof Area [sf] (70%)	Sidewalk Area [sf] (10%)	Driveway Area [sf] (20%)
Townhome22	0	0	0	0
SingleFamily39	0	0	0	0
SingleFamily40	0	0	0	0
SingleFamily50	269,295	188,507	26,930	53,859
SingleFamily60	0	0	0	0
<i>Totals</i>	269,295	188,507	26,930	53,859

**VIII. TOTAL DRAINAGE AREA RESULT**

Total Area per GIS Calc = 16.40 acres  
**714538** sf

Composite SCS CN = 89

Total Impervious Area = 398669 sf

% Impervious = 55.8%

**IX. TIME OF CONCENTRATION**

*Time of concentration is assumed to be 5 minutes.*

Time of Concentration =	5.00	minutes
SCS Lag Time =	3.00	minutes (SCS Lag = 0.6 * Tc)
Time Increment =	0.87	minutes (= 0.29 * SCS Lag)

#### I. ONSITE SCS CURVE NUMBERS - LAND COVER

HSG	Open	Wooded	Roads	Sidewalk	Pond	Crops
A	39	30	98	98	100	67
B	61	55	98	98	100	78
B/D	80	77	98	98	100	89
C	74	70	98	98	100	85
D	80	77	98	98	100	89

BasinID:

## **II. ONSITE SCS CURVE NUMBERS - LOTS**

HSG	22' Townhome	39' Single Family	40' Single Family	50' Single Family	60' Single Family
A	93	77	76	74	69
B	95	85	84	83	80
B/D	96	92	91	91	89
C	96	90	89	88	86
D	96	92	91	91	89

### III. OFFSITE SCS CURVE NUMBERS - ZONING

HSG	Right-Of-Way	Zoning - High Res (1/3 acre)	Zoning - Med Res (1/2 acre)	Zoning - Low Res (1 acre)	Zoning - Commercial	Zoning - MU Neighborhood	Zoning - Business Park	Zoning - Preserved Open	Town Center	School
A	83	57	54	51	89	72	89	39	89	75
B	89	72	70	68	92	85	92	61	92	88
B/D	93	86	85	84	95	92	95	80	95	93
C	91	82	80	79	94	90	94	74	94	91
D	93	86	85	84	95	92	95	80	95	93

#### **IV. ONSITE AREAS - LAND COVER**

HSG	Open	Onsite Wooded	Onsite Roads	Onsite Sidewalk	Pond	Onsite Crops
A	6505	0	11402	4011	0	0
B	1734	0	3686	1333	0	0
B/D	113	0	0	0	0	0
C	0	0	0	0	0	0
D	57013	0	33703	11780	7845	0

V. ONSITE AREAS - LOTS

HSG	Townhome22	SingleFamily39	SingleFamily40	SingleFamily50	SingleFamily60
A	0	0	0	39602	0
B	0	0	0	30142	0
B/D	0	0	0	0	0
C	0	0	0	0	0
D	0	0	0	155736	0

## **VI OFFSITE AREAS - ZONING**

**VII. LOT BREAKDOWN**

Contributing Area	Total Impervious [sf]	Roof Area [sf] (70%)	Sidewalk Area [sf] (10%)	Driveway Area [sf] (20%)
Townhome22	0	0	0	0
SingleFamily39	0	0	0	0
SingleFamily40	0	0	0	0
SingleFamily50	131,988	92,391	13,199	26,398
SingleFamily60	0	0	0	0
<i>Totals</i>	131,988	92,391	13,199	26,398

**VIII. TOTAL DRAINAGE AREA RESULT**

Total Area per GIS Calc = 8.37 acres  
364606 sf

Composite SCS CN = 87

Total Impervious Area = 197903 sf

% Impervious = 54.3%

**IX. TIME OF CONCENTRATION**

*Time of concentration is assumed to be 5 minutes.*

Time of Concentration =	5.00	minutes
SCS Lag Time =	3.00	minutes (SCS Lag = 0.6 * Tc)
Time Increment =	0.87	minutes (= 0.29 * SCS Lag)

## I. ONSITE SCS CURVE NUMBERS - LAND COVER

HSG	Open	Wooded	Roads	Sidewalk	Pond	Crops
A	39	30	98	98	100	67
B	61	55	98	98	100	78
B/D	80	77	98	98	100	89
C	74	70	98	98	100	85
D	80	77	98	98	100	89

BasinID:

## **II. ONSITE SCS CURVE NUMBERS - LOTS**

HSG	22' Townhome	39' Single Family	40' Single Family	50' Single Family	60' Single Family
A	93	77	76	74	69
B	95	85	84	83	80
B/D	96	92	91	91	89
C	96	90	89	88	86
D	96	92	91	91	89

### III. OFFSITE SCS CURVE NUMBERS - ZONING

HSG	Right-Of-Way	Zoning - High Res (1/3 acre)	Zoning - Med Res (1/2 acre)	Zoning - Low Res (1 acre)	Zoning - Commercial	Zoning - MU Neighborhood	Zoning - Business Park	Zoning - Preserved Open	Town Center	School
A	83	57	54	51	89	72	89	39	89	75
B	89	72	70	68	92	85	92	61	92	88
B/D	93	86	85	84	95	92	95	80	95	93
C	91	82	80	79	94	90	94	74	94	91
D	93	86	85	84	95	92	95	80	95	93

#### **IV. ONSITE AREAS - LAND COVER**

HSG	Open	Onsite Wooded	Onsite Roads	Onsite Sidewalk	Pond	Onsite Crops
A	24271	0	8528	2982	0	0
B	27857	0	18300	5506	0	0
B/D	0	0	0	0	0	0
C	0	0	0	0	0	0
D	95003	64869	58724	17815	13690	0

#### V. ONSITE AREAS - LOTS

HSG	Townhome22	SingleFamily39	SingleFamily40	SingleFamily50	SingleFamily60
A	0	0	0	46999	0
B	22302	0	0	18988	0
B/D	0	0	0	0	0
C	0	0	0	0	0
D	25619	0	0	166608	0

VI. OFFSITE AREAS - ZONING

**VII. LOT BREAKDOWN**

Contributing Area	Total Impervious [sf]	Roof Area [sf] (70%)	Sidewalk Area [sf] (10%)	Driveway Area [sf] (20%)
Townhome22	43,564	30,495	4,356	8,713
SingleFamily39	0	0	0	0
SingleFamily40	0	0	0	0
SingleFamily50	136,153	95,307	13,615	27,231
SingleFamily60	0	0	0	0
<i>Totals</i>	179,718	125,802	17,972	35,944

**VIII. TOTAL DRAINAGE AREA RESULT**

Total Area per GIS Calc = 14.19 acres  
**618061** sf

Composite SCS CN = 85  
Total Impervious Area = **291573** sf

% Impervious = 47.2%

**IX. TIME OF CONCENTRATION**

*Time of concentration is assumed to be 5 minutes.*

Time of Concentration =	5.00	minutes
SCS Lag Time =	3.00	minutes (SCS Lag = 0.6 * Tc)
Time Increment =	0.87	minutes (= 0.29 * SCS Lag)

**I. ONSITE SCS CURVE NUMBERS - LAND COVER**

HSG	Open	Wooded	Roads	Sidewalk	Pond	Crops
A	39	30	98	98	100	67
B	61	55	98	98	100	78
B/D	80	77	98	98	100	89
C	74	70	98	98	100	85
D	80	77	98	98	100	89

BasinID: 1

**II. ONSITE SCS CURVE NUMBERS - LOTS**

HSG	22' Townhome	39' Single Family	40' Single Family	50' Single Family	60' Single Family
A	93	77	76	74	69
B	95	85	84	83	80
B/D	96	92	91	91	89
C	96	90	89	88	86
D	96	92	91	91	89

**III. OFFSITE SCS CURVE NUMBERS - ZONING**

HSG	Right-Of-Way	Zoning - High Res (1/3 acre)	Zoning - Med Res (1/2 acre)	Zoning - Low Res (1 acre)	Zoning - Commercial	Zoning - MU Neighborhood	Zoning - Business Park	Zoning - Preserved Open	Town Center	School
A	83	57	54	51	89	72	89	39	89	75
B	89	72	70	68	92	85	92	61	92	88
B/D	93	86	85	84	95	92	95	80	95	93
C	91	82	80	79	94	90	94	74	94	91
D	93	86	85	84	95	92	95	80	95	93

**IV. ONSITE AREAS - LAND COVER**

HSG	Open	Onsite Wooded	Onsite Roads	Onsite Sidewalk	Pond	Onsite Crops
A	0	0	0	0	0	0
B	454874	140808	7655	11691	4131	110741
B/D	38957	238736	0	0	1148	0
C	0	1512	0	0	0	0
D	159038	21927	29	174	295367	8174

**V. ONSITE AREAS - LOTS**

HSG	Townhome22	SingleFamily39	SingleFamily40	SingleFamily50	SingleFamily60
A	0	0	0	0	0
B	0	0	0	0	13066
B/D	0	0	0	0	0
C	0	0	0	0	0
D	0	0	0	0	2271

**VI. OFFSITE AREAS - ZONING**

HSG	90% impervious	30% impervious	25% impervious	20% impervious	85% impervious	65% impervious	85% impervious	0% impervious	85% impervious	72% impervious
	Right of Way	High Density Residential	Medium Density Residential	Low Density Residential	Commercial	Mixed Use Neighborhood	Business Park	Preserved Open Space	Town Center	School
A	0	0	0	0	0	0	0	0	0	0
B	178555	0	49735	12823	0	532407	0	0	0	780297
B/D	16957	0	0	0	0	179661	0	0	0	369944
C	0	0	0	0	0	77938	0	0	0	0
D	153068	0	3316	985806	0	617429	0	0	0	2652145

**VII. LOT BREAKDOWN**

Contributing Area	Total Impervious [sf]	Roof Area [sf] (70%)	Sidewalk Area [sf] (10%)	Driveway Area [sf] (20%)
Townhome22	0	0	0	0
SingleFamily39	0	0	0	0
SingleFamily40	0	0	0	0
SingleFamily50	0	0	0	0
SingleFamily60	7,668	5,368	767	1,534
<b>Totals</b>	<b>7,668</b>	<b>5,368</b>	<b>767</b>	<b>1,534</b>

**VIII. TOTAL DRAINAGE AREA RESULT**

Total Area per GIS Calc =	186.42	acres
	<b>8120377</b>	sf
Composite SCS CN =	87	
Total Impervious Area =	<b>4206476</b>	sf
% Impervious =	51.8%	

**IX. TIME OF CONCENTRATION**

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

**Segment 1: Overland Flow**

Length =	100	ft
Top Elev =	426.00	ft
Bot Elev =	425.00	ft
Height =	1	ft
Slope =	0.0100	ft/ft
Manning's n =	0.17	cultivated soils, residue cover
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
<b>Segment Time =</b>	<b>13.74</b>	<b>minutes</b>

**Segment 2: Concentrated Flow**

Length =	2645	ft
Top Elev =	425.00	ft
Bot Elev =	374.00	ft
Height =	51	ft
Slope =	0.0193	ft/ft
Paved ? =	No	
Velocity =	2.24	ft/sec
<b>Segment Time =</b>	<b>19.68</b>	<b>minutes</b>

**Segment 3: Open Water Flow**

Length =	580	ft
Top Elev =	374.00	ft
Bot Elev =	372.00	ft
<b>Segment Time =</b>	<b>0.00</b>	<b>minutes</b>

**Segment 4: Channel Flow**

Length =	2088	ft
Top Elev =	372.00	ft
Bot Elev =	344.00	ft
Height =	28	ft
Slope =	0.0134	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	15.00	sf (assume 5'w x 3'h channel)
Wetted Perimeter =	11.00	lf (assume 5'w x 3'h channel)
Channel Velocity =	4.72	ft/sec
<b>Segment Time =</b>	<b>7.38</b>	<b>minutes</b>

Time of Concentration =	40.80	minutes
SCS Lag Time =	24.48	minutes (SCS Lag = 0.6* Tc)
Time Increment =	7:10	minutes (= 0.29*SCS Lag)

**I. ONSITE SCS CURVE NUMBERS - LAND COVER**

HSG	Open	Wooded	Roads	Sidewalk	Pond	Crops
A	39	30	98	98	100	67
B	61	55	98	98	100	78
B/D	80	77	98	98	100	89
C	74	70	98	98	100	85
D	80	77	98	98	100	89

BasinID: 2

**II. ONSITE SCS CURVE NUMBERS - LOTS**

HSG	22' Townhome	39' Single Family	40' Single Family	50' Single Family	60' Single Family
A	93	77	76	74	69
B	95	85	84	83	80
B/D	96	92	91	91	89
C	96	90	89	88	86
D	96	92	91	91	89

**III. OFFSITE SCS CURVE NUMBERS - ZONING**

HSG	Right-Of-Way	Zoning - High Res (1/3 acre)	Zoning - Med Res (1/2 acre)	Zoning - Low Res (1 acre)	Zoning - Commercial	Zoning - MU Neighborhood	Zoning - Business Park	Zoning - Preserved Open	Town Center	School
A	83	57	54	51	89	72	89	39	89	75
B	89	72	70	68	92	85	92	61	92	88
B/D	93	86	85	84	95	92	95	80	95	93
C	91	82	80	79	94	90	94	74	94	91
D	93	86	85	84	95	92	95	80	95	93

**IV. ONSITE AREAS - LAND COVER**

HSG	Open	Onsite Wooded	Onsite Roads	Onsite Sidewalk	Pond	Onsite Crops
A	0	0	0	0	0	0
B	31858	19412	0	6260	0	22619
B/D	0	52628	0	0	0	0
C	0	0	0	0	0	0
D	22027	23834	0	3127	0	4670

**V. ONSITE AREAS - LOTS**

HSG	Townhome22	SingleFamily39	SingleFamily40	SingleFamily50	SingleFamily60
A	0	0	0	0	0
B	0	17	0	0	0
B/D	0	0	0	0	0
C	0	0	0	0	0
D	0	0	0	0	0

**VI. OFFSITE AREAS - ZONING**

HSG	90% impervious	30% impervious	25% impervious	20% impervious	85% impervious	65% impervious	85% impervious	0% impervious	85% impervious	72% impervious
	Right of Way	High Density Residential	Medium Density Residential	Low Density Residential	Commercial	Mixed Use Neighborhood	Business Park	Preserved Open Space	Town Center	School
A	0	0	0	0	0	0	0	0	0	0
B	100879	0	0	0	0	230704	0	0	0	0
B/D	37900	0	0	0	0	38861	0	0	0	0
C	0	0	0	0	0	0	0	0	0	0
D	442930	0	0	782428	0	543504	0	0	0	0

#### VII. LOT BREAKDOWN

Contributing Area	Total Impervious [sf]	Roof Area [sf] (70%)	Sidewalk Area [sf] (10%)	Driveway Area [sf] (20%)
Townhome22	0	0	0	0
SingleFamily39	11	8	1	2
SingleFamily40	0	0	0	0
SingleFamily50	0	0	0	0
SingleFamily60	0	0	0	0
<i>Totals</i>	<b>11</b>	<b>8</b>	<b>1</b>	<b>2</b>

#### VIII. TOTAL DRAINAGE AREA RESULT

Total Area per GIS Calc =	54.26	acres
	<b>2363659</b>	sf
Composite SCS CN =	87	
Total Impervious Area =	<b>1217917</b>	sf
% Impervious =	51.5%	

#### IX. TIME OF CONCENTRATION

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

##### Segment 1: Overland Flow

Length =	100	ft
Top Elev =	427.00	ft
Bot Elev =	426.00	ft
Height =	1	ft
Slope =	0.0100	ft/ft
Manning's n =	0.17	cultivated soils, residue cover
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
<b>Segment Time =</b>	<b>13.74</b>	<b>minutes</b>

##### Segment 2: Concentrated Flow

Length =	2541	ft
Top Elev =	426.00	ft
Bot Elev =	368.00	ft
Height =	58	ft
Slope =	0.0228	ft/ft
Paved ? =	No	
Velocity =	2.44	ft/sec
<b>Segment Time =</b>	<b>17.37</b>	<b>minutes</b>

Time of Concentration =	31.12	minutes
SCS Lag Time =	18.67	minutes (SCS Lag = 0.6 * Tc)
Time Increment =	5.41	minutes (= 0.29 * SCS Lag)

## I. ONSITE SCS CURVE NUMBERS - LAND COVER

HSG	Open	Wooded	Roads	Sidewalk	Pond	Crops
A	39	30	98	98	100	67
B	61	55	98	98	100	78
B/D	80	77	98	98	100	89
C	74	70	98	98	100	85
D	80	77	98	98	100	89

BasinID: [REDACTED]

## **II. ONSITE SCS CURVE NUMBERS - LOTS**

HSG	22' Townhome	39' Single Family	40' Single Family	50' Single Family	60' Single Family
A	93	77	76	74	69
B	95	85	84	83	80
B/D	96	92	91	91	89
C	96	90	89	88	86
D	96	92	91	91	89

### III. OFFSITE SCS CURVE NUMBERS - ZONING

HSG	Right-Of-Way	Zoning - High Res (1/3 acre)	Zoning - Med Res (1/2 acre)	Zoning - Low Res (1 acre)	Zoning - Commercial	Zoning - MU Neighborhood	Zoning - Business Park	Zoning - Preserved Open	Town Center	School
A	83	57	54	51	89	72	89	39	89	75
B	89	72	70	68	92	85	92	61	92	88
B/D	93	86	85	84	95	92	95	80	95	93
C	91	82	80	79	94	90	94	74	94	91
D	93	86	85	84	95	92	95	80	95	93

#### **IV. ONSITE AREAS - LAND COVER**

HSG	Open	Onsite Wooded	Onsite Roads	Onsite Sidewalk	Pond	Onsite Crops
A	0	0	0	0	0	0
B	0	0	0	0	0	0
B/D	0	0	0	0	0	0
C	9831	10071	0	0	0	0
D	33156	180414	0	0	0	0

V. ONSITE AREAS - LOTS

HSG	Townhome22	SingleFamily39	SingleFamily40	SingleFamily50	SingleFamily60
A	0	0	0	0	0
B	0	0	0	0	0
B/D	0	0	0	0	0
C	0	0	0	54	0
D	0	0	0	916	0

## **VI OFFSITE AREAS - ZONING**

#### VII. LOT BREAKDOWN

Contributing Area	Total Impervious [sf]	Roof Area [sf] (70%)	Sidewalk Area [sf] (10%)	Driveway Area [sf] (20%)
Townhome22	0	0	0	0
SingleFamily39	0	0	0	0
SingleFamily40	0	0	0	0
SingleFamily50	568	397	57	114
SingleFamily60	0	0	0	0
<b>Totals</b>	<b>568</b>	<b>397</b>	<b>57</b>	<b>114</b>

#### VIII. TOTAL DRAINAGE AREA RESULT

Total Area per GIS Calc =	5.38	acres
	<b>234442</b>	sf
Composite SCS CN =	77	
Total Impervious Area =	<b>568</b>	sf
% Impervious =	0.2%	

#### IX. TIME OF CONCENTRATION

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

**Segment 1: Overland Flow**

Length =	100	ft
Top Elev =	368.00	ft
Bot Elev =	363.00	ft
Height =	5	ft
Slope =	0.0500	ft/ft
Manning's n =	0.24	dense grasses
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
<b>Segment Time =</b>	<b>9.51</b>	<b>minutes</b>

**Segment 2: Concentrated Flow**

Length =	881	ft
Top Elev =	363.00	ft
Bot Elev =	336.00	ft
Height =	27	ft
Slope =	0.0306	ft/ft
Paved ? =	No	
Velocity =	2.82	ft/sec
<b>Segment Time =</b>	<b>5.20</b>	<b>minutes</b>

**Segment 3: Channel Flow**

Length =	249	ft
Top Elev =	336.00	ft
Bot Elev =	333.00	ft
Height =	3	ft
Slope =	0.0120	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	15.00	sf (assume 5'w x 3'h channel)
Wetted Perimeter =	11.00	If (assume 5'w x 3'h channel)
Channel Velocity =	4.47	ft/sec
<b>Segment Time =</b>	<b>0.93</b>	<b>minutes</b>

Time of Concentration =	15.64	minutes
SCS Lag Time =	9.38	minutes (SCS Lag = 0.6* Tc)
Time Increment =	2.72	minutes (= 0.29*SCS Lag)

**I. ONSITE SCS CURVE NUMBERS - LAND COVER**

HSG	Open	Wooded	Roads	Sidewalk	Pond	Crops
A	39	30	98	98	100	67
B	61	55	98	98	100	78
B/D	80	77	98	98	100	89
C	74	70	98	98	100	85
D	80	77	98	98	100	89

BasinID: 4

**II. ONSITE SCS CURVE NUMBERS - LOTS**

HSG	22' Townhome	39' Single Family	40' Single Family	50' Single Family	60' Single Family
A	93	77	76	74	69
B	95	85	84	83	80
B/D	96	92	91	91	89
C	96	90	89	88	86
D	96	92	91	91	89

**III. OFFSITE SCS CURVE NUMBERS - ZONING**

HSG	Right-Of-Way	Zoning - High Res (1/3 acre)	Zoning - Med Res (1/2 acre)	Zoning - Low Res (1 acre)	Zoning - Commercial	Zoning - MU Neighborhood	Zoning - Business Park	Zoning - Preserved Open	Town Center	School
A	83	57	54	51	89	72	89	39	89	75
B	89	72	70	68	92	85	92	61	92	88
B/D	93	86	85	84	95	92	95	80	95	93
C	91	82	80	79	94	90	94	74	94	91
D	93	86	85	84	95	92	95	80	95	93

**IV. ONSITE AREAS - LAND COVER**

HSG	Open	Onsite Wooded	Onsite Roads	Onsite Sidewalk	Pond	Onsite Crops
A	0	0	0	0	0	0
B	0	0	0	0	0	0
B/D	94729	334348	0	5	0	0
C	65141	78005	0	0	0	0
D	101563	97981	2610	727	0	0

**V. ONSITE AREAS - LOTS**

HSG	Townhome22	SingleFamily39	SingleFamily40	SingleFamily50	SingleFamily60
A	0	0	0	0	0
B	0	0	0	0	0
B/D	0	0	0	0	0
C	0	0	0	138	0
D	0	0	0	0	732

**VI. OFFSITE AREAS - ZONING**

HSG	90% impervious	30% impervious	25% impervious	20% impervious	85% impervious	65% impervious	85% impervious	0% impervious	85% impervious	72% impervious
	Right of Way	High Density Residential	Medium Density Residential	Low Density Residential	Commercial	Mixed Use Neighborhood	Business Park	Preserved Open Space	Town Center	School
A	0	0	0	0	0	0	0	0	0	0
B	0	0	0	0	0	77543	0	0	0	0
B/D	0	0	0	0	0	36707	0	0	0	0
C	0	0	0	0	0	45463	0	0	0	0
D	0	0	0	0	0	311989	0	0	0	0

**VII. LOT BREAKDOWN**

Contributing Area	Total Impervious [sf]	Roof Area [sf] (70%)	Sidewalk Area [sf] (10%)	Driveway Area [sf] (20%)
Townhome22	0	0	0	0
SingleFamily39	0	0	0	0
SingleFamily40	0	0	0	0
SingleFamily50	81	57	8	16
SingleFamily60	366	256	37	73
<b>Totals</b>	<b>447</b>	<b>313</b>	<b>45</b>	<b>89</b>

**VIII. TOTAL DRAINAGE AREA RESULT**

Total Area per GIS Calc =	28.64	acres
	<b>1247681</b>	sf
Composite SCS CN =	82	
Total Impervious Area =	<b>310395</b>	sf
% Impervious =	24.9%	

**IX. TIME OF CONCENTRATION**

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

**Segment 1: Overland Flow**

Length =	100	ft
Top Elev =	389.00	ft
Bot Elev =	388.00	ft
Height =	1	ft
Slope =	0.0100	ft/ft
Manning's n =	0.17	cultivated soils, residue cover
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
<b>Segment Time =</b>	<b>13.74</b>	<b>minutes</b>

**Segment 2: Concentrated Flow**

Length =	1855	ft
Top Elev =	388.00	ft
Bot Elev =	339.00	ft
Height =	49	ft
Slope =	0.0264	ft/ft
Paved ? =	No	
Velocity =	2.62	ft/sec
<b>Segment Time =</b>	<b>11.79</b>	<b>minutes</b>

**Segment 3: Channel Flow**

Length =	2366	ft
Top Elev =	339.00	ft
Bot Elev =	302.00	ft
Height =	37	ft
Slope =	0.0156	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	15.00	sf (assume 5'w x 3'h channel)
Wetted Perimeter =	11.00	If (assume 5'w x 3'h channel)
Channel Velocity =	5.09	ft/sec
<b>Segment Time =</b>	<b>7.74</b>	<b>minutes</b>

Time of Concentration =	33.28	minutes
SCS Lag Time =	19.97	minutes (SCS Lag = 0.6* Tc)
Time Increment =	5.79	minutes (= 0.29*SCS Lag)

I. ONSITE SCS CURVE NUMBERS - LAND COVER

HSG	Open	Wooded	Roads	Sidewalk	Pond	Crops
A	39	30	98	98	100	67
B	61	55	98	98	100	78
B/D	80	77	98	98	100	89
C	74	70	98	98	100	85
D	80	77	98	98	100	89

BasinID: 9

II. ONSITE SCS CURVE NUMBERS - LOTS

HSG	22' Townhome	39' Single Family	40' Single Family	50' Single Family	60' Single Family
A	93	77	76	74	69
B	95	85	84	83	80
B/D	96	92	91	91	89
C	96	90	89	88	86
D	96	92	91	91	89

III. OFFSITE SCS CURVE NUMBERS - ZONING

HSG	Right-Of-Way	Zoning - High Res (1/3 acre)	Zoning - Med Res (1/2 acre)	Zoning - Low Res (1 acre)	Zoning - Commercial	Zoning - MU Neighborhood	Zoning - Business Park	Zoning - Preserved Open	Town Center	School
A	83	57	54	51	89	72	89	39	89	75
B	89	72	70	68	92	85	92	61	92	88
B/D	93	86	85	84	95	92	95	80	95	93
C	91	82	80	79	94	90	94	74	94	91
D	93	86	85	84	95	92	95	80	95	93

IV. ONSITE AREAS - LAND COVER

HSG	Open	Onsite Wooded	Onsite Roads	Onsite Sidewalk	Pond	Onsite Crops
A	19289	0	0	0	0	0
B	463037	165474	0	11246	0	3659
B/D	27508	6355	0	4062	0	0
C	0	0	0	0	0	0
D	632653	1457483	0	11685	0	0

V. ONSITE AREAS - LOTS

HSG	Townhome22	SingleFamily39	SingleFamily40	SingleFamily50	SingleFamily60
A	0	0	0	0	0
B	0	0	0	0	0
B/D	0	0	0	0	0
C	0	0	0	0	0
D	96	0	0	0	0

VI. OFFSITE AREAS - ZONING

HSG	90% impervious	30% impervious	25% impervious	20% impervious	85% impervious	65% impervious	85% impervious	0% impervious	85% impervious	72% impervious
	Right of Way	High Density Residential	Medium Density Residential	Low Density Residential	Commercial	Mixed Use Neighborhood	Business Park	Preserved Open Space	Town Center	School
A	32917	0	310	0	0	0	272	17137	0	0
B	1041178	3084838	2087277	40019	0	294169	868	195327	284266	20637
B/D	68437	0	0	0	0	145164	0	0	0	0
C	0	0	0	0	0	0	0	0	0	0
D	1328907	2241086	1872118	80782	43820	531367	1360	1483036	75630	309591

VII. LOT BREAKDOWN

Contributing Area	Total Impervious [sf]	Roof Area [sf] (70%)	Sidewalk Area [sf] (10%)	Driveway Area [sf] (20%)
Townhome22	87	61	9	17
SingleFamily39	0	0	0	0
SingleFamily40	0	0	0	0
SingleFamily50	0	0	0	0
SingleFamily60	0	0	0	0
<i>Totals</i>	87	61	9	17

VIII. TOTAL DRAINAGE AREA RESULT

Total Area per GIS Calc =	415.13	acres
	18083064	sf
Composite SCS CN =	80	
Total Impervious Area =	6077244	sf
% Impervious =	33.6%	

IX. TIME OF CONCENTRATION

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

Segment 1: Overland Flow

Length =	100	ft
Top Elev =	440.00	ft
Bot Elev =	438.00	ft
Height =	2	ft
Slope =	0.0200	ft/ft
Manning's n =	0.24	dense grasses
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
Segment Time =	<b>13.72</b>	minutes

Segment 2: Concentrated Flow

Length =	2989	ft
Top Elev =	438.00	ft
Bot Elev =	372.00	ft
Height =	66	ft
Slope =	0.0221	ft/ft
Paved ? =	No	
Velocity =	2.40	ft/sec
Segment Time =	<b>20.78</b>	minutes

Segment 3: Open Water Flow

Length =	655	ft
Top Elev =	372.00	ft
Bot Elev =	372.00	ft
Segment Time =	<b>0.00</b>	minutes

Segment 4: Concentrated Flow

Length =	2379	ft
Top Elev =	372.00	ft
Bot Elev =	320.00	ft
Height =	52	ft
Slope =	0.0219	ft/ft
Paved ? =	No	
Velocity =	2.39	ft/sec
Segment Time =	<b>16.62</b>	minutes

Segment 5: Channel Flow

Length =	3730	ft
Top Elev =	320.00	ft
Bot Elev =	292.00	ft
Height =	28	ft
Slope =	0.0075	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	32.00	sf (assume 8'w x 4'h channel)
Wetted Perimeter =	16.00	If (assume 8'w x 4'h channel)
Channel Velocity =	4.55	ft/sec
Segment Time =	<b>13.65</b>	minutes

Time of Concentration =	64.78	minutes
SCS Lag Time =	38.87	minutes (SCS Lag = 0.6 * Tc)
Time Increment =	11.27	minutes (= 0.29 * SCS Lag)

**REACH DATA****Reach 1 - POA 1 to POA 4**

Length = 2988 ft  
Top Elev = 344.00 ft  
Bot Elev = 302.00 ft  
Height = 42 ft  
Slope = 0.0141 ft/ft  
Manning's n = 0.045 natural channel  
Flow Area = 10.00 sf (assume 5'w x 2'h channel)  
Wetted Perimeter = 9.00 ft (assume 5'w x 2'h channel)  
Channel Velocity = 4.21 ft/sec  
Reach Travel Time = **11.83 minutes**

**Reach 2 - SCM A to POA 1****Segment 1: Concentrated Flow**

Length = 647 ft  
Top Elev = 377.00 ft  
Bot Elev = 368.00 ft  
Height = 9 ft  
Slope = 0.0139 ft/ft  
Paved ? = No  
Velocity = 1.90 ft/sec

**Segment 2: Channel Flow**

Length = 2038 ft  
Top Elev = 368.00 ft  
Bot Elev = 344.00 ft  
Height = 24 ft  
Slope = 0.0118 ft/ft  
Manning's n = 0.045 natural channel  
Flow Area = 12.00 sf (assume 6'w x 2'h channel)  
Wetted Perimeter = 10.00 ft (assume 6'w x 2'h channel)  
Channel Velocity = 4.06 ft/sec

Segment Time = **5.67 minutes**Reach Travel Time = **8.37 minutes**Total Reach Travel Time = **14.04****Reach 3 - SCM C to POA 1****Segment 1: Concentrated Flow**

Length = 83 ft  
Top Elev = 370.00 ft  
Bot Elev = 366.00 ft  
Height = 4 ft  
Slope = 0.0482 ft/ft  
Paved ? = No  
Velocity = 3.54 ft/sec

**Segment 2: Channel Flow**

Length = 1220 ft  
Top Elev = 366.00 ft  
Bot Elev = 344.00 ft  
Height = 22 ft  
Slope = 0.0180 ft/ft  
Manning's n = 0.045 natural channel  
Flow Area = 8.00 sf (assume 4'w x 2'h channel)  
Wetted Perimeter = 8.00 ft (assume 4'w x 2'h channel)  
Channel Velocity = 4.45 ft/sec

Segment Time = **0.39 minutes**Reach Travel Time = **4.57 minutes**Total Reach Travel Time = **4.96****Reach 4 - SCM F to POA 4****Segment 1: Concentrated Flow**

Length = 77 ft  
Top Elev = 339.00 ft  
Bot Elev = 336.00 ft  
Height = 3 ft  
Slope = 0.0390 ft/ft  
Paved ? = No  
Velocity = 3.18 ft/sec

**Segment 2: Channel Flow**

Length = 2292 ft  
Top Elev = 336.00 ft  
Bot Elev = 302.00 ft  
Height = 34 ft  
Slope = 0.0148 ft/ft  
Manning's n = 0.045 natural channel  
Flow Area = 10.00 sf (assume 5'w x 2'h channel)  
Wetted Perimeter = 9.00 ft (assume 5'w x 2'h channel)  
Channel Velocity = 4.33 ft/sec

Segment Time = **0.40 minutes**Reach Travel Time = **8.83 minutes**Total Reach Travel Time = **9.23****Reach 5 - SCM B to POA 1****Segment 1: Concentrated Flow**

Length = 161 ft  
Top Elev = 375.00 ft  
Bot Elev = 363.00 ft  
Height = 12 ft  
Slope = 0.0745 ft/ft  
Paved ? = No  
Velocity = 4.40 ft/sec

**Segment 2: Channel Flow**

Length = 1850 ft  
Top Elev = 363.00 ft  
Bot Elev = 344.00 ft  
Height = 19 ft  
Slope = 0.0103 ft/ft  
Manning's n = 0.045 natural channel  
Flow Area = 12.00 sf (assume 6'w x 2'h channel)  
Wetted Perimeter = 10.00 ft (assume 6'w x 2'h channel)  
Channel Velocity = 3.79 ft/sec

Segment Time = **0.61 minutes**Reach Travel Time = **8.14 minutes**Total Reach Travel Time = **8.75**

**Reach 6 - SCM G to POA 4**

**Segment 1: Concentrated Flow**

Length =	75	ft
Top Elev =	338.00	ft
Bot Elev =	337.00	ft
Height =	1	ft
Slope =	0.0133	ft/ft
Paved ? =	No	
Velocity =	1.86	ft/sec

**Segment 2: Channel Flow**

Length =	1566	
Top Elev =	337.00	
Bot Elev =	303.00	
Height =	34	
Slope =	0.0217	
Manning's n =	0.045	
Flow Area =	12.00	
Wetted Perimeter =	10.00	
Channel Velocity =	5.51	

**Segment Time =** **0.67** minutes      **Reach Travel Time =** **4.74**

**Total Reach Travel Time =** **5.41**

**Reach 7 - SCM H to POA 4**

**Segment 1: Concentrated Flow**

Length =	482	ft
Top Elev =	374.00	ft
Bot Elev =	361.00	ft
Height =	13	ft
Slope =	0.0270	ft/ft
Paved ? =	No	
Velocity =	2.65	ft/sec

**Segment 2: Channel Flow**

Length =	1567	
Top Elev =	361.00	
Bot Elev =	344.00	
Height =	17	
Slope =	0.0108	
Manning's n =	0.045	
Flow Area =	12.00	
Wetted Perimeter =	10.00	
Channel Velocity =	3.89	

**Segment Time =** **3.03** minutes      **Reach Travel Time =** **6.71**

**Total Reach Travel Time =** **9.74**

**Reach 8 - SCM I to POA 4**

**Segment 1: Concentrated Flow**

Length =	482	ft
Top Elev =	308.00	ft
Bot Elev =	296.00	ft
Height =	12	ft
Slope =	0.0249	ft/ft
Paved ? =	No	
Velocity =	2.55	ft/sec

**Segment 2: Channel Flow**

Length =	805	
Top Elev =	296.00	
Bot Elev =	292.00	
Height =	4	
Slope =	0.0050	
Manning's n =	0.045	
Flow Area =	12.00	
Wetted Perimeter =	10.00	
Channel Velocity =	2.64	

**Segment Time =** **3.16** minutes      **Reach Travel Time =** **5.09**

**Total Reach Travel Time =** **8.25**

**Reach 9 - SCM J to POA 5**

**Segment 1: Concentrated Flow**

Length =	102	ft
Top Elev =	308.00	ft
Bot Elev =	296.00	ft
Height =	12	ft
Slope =	0.1176	ft/ft
Paved ? =	No	
Velocity =	5.53	ft/sec

**Segment 2: Channel Flow**

Length =	805	
Top Elev =	296.00	
Bot Elev =	291.00	
Height =	5	
Slope =	0.0062	
Manning's n =	0.045	
Flow Area =	12.00	
Wetted Perimeter =	10.00	
Channel Velocity =	2.95	

**Segment Time =** **0.31** minutes      **Reach Travel Time =** **4.55**

**Total Reach Travel Time =** **4.86**

**Scenario: Post  
Development**



**FlexTable: Catchment  
Table (AWH20000-  
CDPackage2.ppc)**

Current Time: 0.00 min

Label	Area (acres)	SCS CN	Time of	Notes
			Concentration (min)	
Sub 2	54.26	87	31.12	POST
Sub 1 Bypass	186.42	87	40.80	POST
Sub 1 to SCM A	11.92	85	5.00	POST
Sub 1 to SCM D	13.20	81	5.00	POST
Sub 1 to SCM C	15.68	86	5.00	POST
Sub 1 to SCM E	17.39	87	5.00	POST
Sub 4 to SCM F	18.72	87	5.00	POST
Sub 4 Bypass	28.64	82	33.28	POST
Sub 4 to SCM G	13.66	90	5.00	POST
Sub 4 to SCM H	16.40	89	5.00	POST
Sub 5 to SCM J	14.19	85	5.00	POST
Sub 4 to SCM I	8.37	87	5.00	POST
Sub 1 to SCM B	10.26	87	5.00	POST
Sub 3	5.38	77	15.64	POST
Sub 5 Bypass	415.13	80	64.78	POST

### Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft³/s)
Sub 2	Post-Dev 1 yr	1	7.253	739.00	70.0
Sub 2	Post-Dev 10 yr	10	16.260	738.00	138.6
Sub 2	Post-Dev 25 yr	25	20.370	738.00	164.5
Sub 1 Bypass	Post-Dev 1 yr	1	24.857	745.00	203.0
Sub 1 Bypass	Post-Dev 10 yr	10	55.735	745.00	409.1
Sub 1 Bypass	Post-Dev 25 yr	25	69.836	745.00	488.8
Sub 1 to SCM A	Post-Dev 1 yr	1	1.460	721.00	31.4
Sub 1 to SCM A	Post-Dev 10 yr	10	3.397	721.00	61.6
Sub 1 to SCM A	Post-Dev 25 yr	25	4.288	721.00	72.2
Sub 1 to SCM D	Post-Dev 1 yr	1	1.325	722.00	28.0
Sub 1 to SCM D	Post-Dev 10 yr	10	3.337	721.00	60.9
Sub 1 to SCM D	Post-Dev 25 yr	25	4.286	721.00	72.9
Sub 1 to SCM C	Post-Dev 1 yr	1	2.014	721.00	43.5
Sub 1 to SCM C	Post-Dev 10 yr	10	4.598	721.00	83.2
Sub 1 to SCM C	Post-Dev 25 yr	25	5.781	721.00	97.0
Sub 1 to SCM E	Post-Dev 1 yr	1	2.342	721.00	50.6
Sub 1 to SCM E	Post-Dev 10 yr	10	5.246	721.00	94.6
Sub 1 to SCM E	Post-Dev 25 yr	25	6.568	721.00	109.7
Sub 4 to SCM F	Post-Dev 1 yr	1	2.519	721.00	54.5
Sub 4 to SCM F	Post-Dev 10 yr	10	5.645	721.00	101.8
Sub 4 to SCM F	Post-Dev 25 yr	25	7.067	721.00	118.0
Sub 4 Bypass	Post-Dev 1 yr	1	3.000	741.00	27.3
Sub 4 Bypass	Post-Dev 10 yr	10	7.410	741.00	61.4
Sub 4 Bypass	Post-Dev 25 yr	25	9.483	741.00	75.0
Sub 4 to SCM G	Post-Dev 1 yr	1	2.110	721.00	45.5
Sub 4 to SCM G	Post-Dev 10 yr	10	4.473	721.00	79.4
Sub 4 to SCM G	Post-Dev 25 yr	25	5.532	721.00	90.8
Sub 4 to SCM H	Post-Dev 1 yr	1	2.422	721.00	52.3
Sub 4 to SCM H	Post-Dev 10 yr	10	5.228	721.00	93.4
Sub 4 to SCM H	Post-Dev 25 yr	25	6.492	721.00	107.2
Sub 5 to SCM J	Post-Dev 1 yr	1	1.737	721.00	37.4
Sub 5 to SCM J	Post-Dev 10 yr	10	4.043	721.00	73.4
Sub 5 to SCM J	Post-Dev 25 yr	25	5.104	721.00	85.9
Sub 4 to SCM I	Post-Dev 1 yr	1	1.127	721.00	24.4
Sub 4 to SCM I	Post-Dev 10 yr	10	2.525	721.00	45.5
Sub 4 to SCM I	Post-Dev 25 yr	25	3.161	721.00	52.8
Sub 1 to SCM B	Post-Dev 1 yr	1	1.382	721.00	29.9
Sub 1 to SCM B	Post-Dev 10 yr	10	3.095	721.00	55.8
Sub 1 to SCM B	Post-Dev 25 yr	25	3.875	721.00	64.7
Sub 3	Post-Dev 1 yr	1	0.435	730.00	5.8
Sub 3	Post-Dev 10 yr	10	1.193	728.00	14.6
Sub 3	Post-Dev 25 yr	25	1.562	728.00	18.0
Sub 5 Bypass	Post-Dev 1 yr	1	38.831	768.00	231.3
Sub 5 Bypass	Post-Dev 10 yr	10	100.054	760.00	574.8
Sub 5 Bypass	Post-Dev 25 yr	25	129.315	760.00	720.9

### Node Summary

## Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft³/s)
POA 4	Post-Dev 1 yr	1	34.347	757.00	247.4
POA 4	Post-Dev 10 yr	10	89.711	755.00	624.0
POA 4	Post-Dev 25 yr	25	115.095	752.00	786.3
POA 2	Post-Dev 1 yr	1	7.253	739.00	70.0
POA 2	Post-Dev 10 yr	10	16.260	738.00	138.6
POA 2	Post-Dev 25 yr	25	20.370	738.00	164.5
	Post-Dev 1 yr	1	0.823	755.00	3.5
	Post-Dev 10 yr	10	2.740	731.00	18.3
	Post-Dev 25 yr	25	3.626	728.00	36.8
	Post-Dev 1 yr	1	1.156	752.00	8.3
	Post-Dev 10 yr	10	3.731	728.00	37.5
	Post-Dev 25 yr	25	4.911	727.00	53.5
	Post-Dev 1 yr	1	1.602	734.00	12.1
	Post-Dev 10 yr	10	4.708	725.00	74.0
POA 1	Post-Dev 25 yr	25	6.126	724.00	88.3
	Post-Dev 1 yr	1	29.068	746.00	215.8
	Post-Dev 10 yr	10	70.647	745.00	500.4
	Post-Dev 25 yr	25	89.638	743.00	620.7
POA 5	Post-Dev 1 yr	1	0.515	785.00	1.1
	Post-Dev 10 yr	10	2.215	729.00	22.8
	Post-Dev 25 yr	25	2.991	728.00	31.6
	Post-Dev 1 yr	1	39.427	768.00	231.5
	Post-Dev 10 yr	10	102.912	760.00	590.9
	Post-Dev 25 yr	25	133.224	760.00	740.7
	Post-Dev 1 yr	1	0.599	902.00	1.2
	Post-Dev 10 yr	10	2.864	731.00	23.1
	Post-Dev 25 yr	25	3.917	727.00	47.9
POA 5	Post-Dev 1 yr	1	0.153	1,440.00	0.2
	Post-Dev 10 yr	10	1.476	731.00	13.6
	Post-Dev 25 yr	25	2.111	728.00	27.1
	Post-Dev 1 yr	1	0.354	1,426.00	0.6
	Post-Dev 10 yr	10	3.136	733.00	23.9
	Post-Dev 25 yr	25	4.395	730.00	36.3
	Post-Dev 1 yr	1	0.322	1,440.00	0.4
	Post-Dev 10 yr	10	2.658	733.00	20.6
	Post-Dev 25 yr	25	3.713	728.00	41.4
	Post-Dev 1 yr	1	0.435	730.00	5.8
	Post-Dev 10 yr	10	1.193	728.00	14.6
	Post-Dev 25 yr	25	1.562	728.00	18.0

## Pond Summary

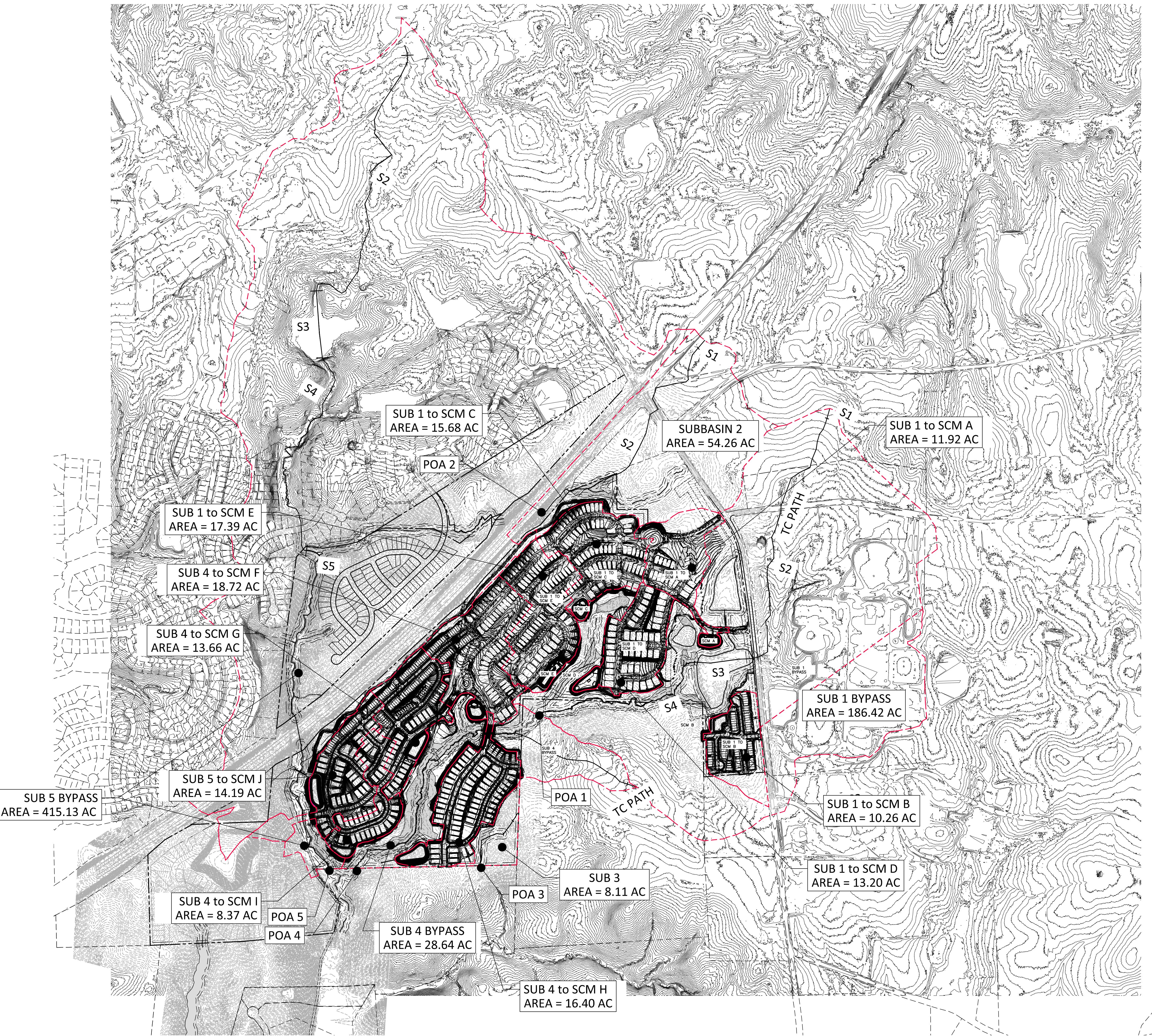
Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft³/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
SCM A (IN)	Post-Dev 1 yr	1	1.460	721.00	31.4	(N/A)	(N/A)
SCM A (OUT)	Post-Dev 1 yr	1	0.823	755.00	3.5	382.45	0.791
SCM A (IN)	Post-Dev 10 yr	10	3.397	721.00	61.6	(N/A)	(N/A)

## Pond Summary

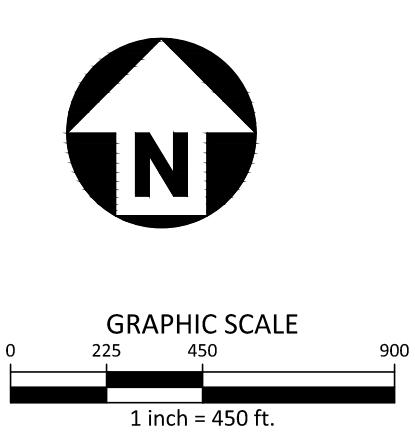
Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft³/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
SCM A (OUT)	Post-Dev 10 yr	10	2.740	731.00	18.3	384.06	1.432
SCM A (IN)	Post-Dev 25 yr	25	4.288	721.00	72.2	(N/A)	(N/A)
SCM A (OUT)	Post-Dev 25 yr	25	3.626	728.00	36.8	384.42	1.590
SCM D (IN)	Post-Dev 1 yr	1	1.325	722.00	28.0	(N/A)	(N/A)
SCM D (OUT)	Post-Dev 1 yr	1	0.449	1,082.00	0.6	355.89	0.925
SCM D (IN)	Post-Dev 10 yr	10	3.337	721.00	60.9	(N/A)	(N/A)
SCM D (OUT)	Post-Dev 10 yr	10	2.092	786.00	2.5	357.64	2.034
SCM D (IN)	Post-Dev 25 yr	25	4.286	721.00	72.9	(N/A)	(N/A)
SCM D (OUT)	Post-Dev 25 yr	25	2.828	756.00	8.6	358.24	2.452
SCM C (IN)	Post-Dev 1 yr	1	2.014	721.00	43.5	(N/A)	(N/A)
SCM C (OUT)	Post-Dev 1 yr	1	1.156	752.00	8.3	378.55	0.985
SCM C (IN)	Post-Dev 10 yr	10	4.598	721.00	83.2	(N/A)	(N/A)
SCM C (OUT)	Post-Dev 10 yr	10	3.731	728.00	37.5	379.95	1.625
SCM C (IN)	Post-Dev 25 yr	25	5.781	721.00	97.0	(N/A)	(N/A)
SCM C (OUT)	Post-Dev 25 yr	25	4.911	727.00	53.5	380.32	1.809
SCM E (IN)	Post-Dev 1 yr	1	2.342	721.00	50.6	(N/A)	(N/A)
SCM E (OUT)	Post-Dev 1 yr	1	1.285	754.00	6.2	357.40	1.288
SCM E (IN)	Post-Dev 10 yr	10	5.246	721.00	94.6	(N/A)	(N/A)
SCM E (OUT)	Post-Dev 10 yr	10	4.165	752.00	21.0	359.07	2.375
SCM E (IN)	Post-Dev 25 yr	25	6.568	721.00	109.7	(N/A)	(N/A)
SCM E (OUT)	Post-Dev 25 yr	25	5.480	730.00	37.8	359.48	2.662
SCM F (IN)	Post-Dev 1 yr	1	2.519	721.00	54.5	(N/A)	(N/A)
SCM F (OUT)	Post-Dev 1 yr	1	1.602	734.00	12.1	346.72	1.115
SCM F (IN)	Post-Dev 10 yr	10	5.645	721.00	101.8	(N/A)	(N/A)
SCM F (OUT)	Post-Dev 10 yr	10	4.708	725.00	74.0	347.80	1.631
SCM F (IN)	Post-Dev 25 yr	25	7.067	721.00	118.0	(N/A)	(N/A)
SCM F (OUT)	Post-Dev 25 yr	25	6.126	724.00	88.3	348.01	1.736
SCM B (IN)	Post-Dev 1 yr	1	1.382	721.00	29.9	(N/A)	(N/A)
SCM B (OUT)	Post-Dev 1 yr	1	0.515	785.00	1.1	379.11	0.896
SCM B (IN)	Post-Dev 10 yr	10	3.095	721.00	55.8	(N/A)	(N/A)
SCM B (OUT)	Post-Dev 10 yr	10	2.215	729.00	22.8	380.13	1.271
SCM B (IN)	Post-Dev 25 yr	25	3.875	721.00	64.7	(N/A)	(N/A)
SCM B (OUT)	Post-Dev 25 yr	25	2.991	728.00	31.6	380.58	1.448
SCM H (IN)	Post-Dev 1 yr	1	2.422	721.00	52.3	(N/A)	(N/A)
SCM H (OUT)	Post-Dev 1 yr	1	0.354	1,426.00	0.6	333.77	2.068
SCM H (IN)	Post-Dev 10 yr	10	5.228	721.00	93.4	(N/A)	(N/A)
SCM H (OUT)	Post-Dev 10 yr	10	3.136	733.00	23.9	334.43	2.502

## Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft³/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
SCM H (IN)	Post-Dev 25 yr	25	6.492	721.00	107.2	(N/A)	(N/A)
SCM H (OUT)	Post-Dev 25 yr	25	4.395	730.00	36.3	335.00	2.894
SCM J (IN)	Post-Dev 1 yr	1	1.737	721.00	37.4	(N/A)	(N/A)
SCM J (OUT)	Post-Dev 1 yr	1	0.599	902.00	1.2	313.18	1.192
SCM J (IN)	Post-Dev 10 yr	10	4.043	721.00	73.4	(N/A)	(N/A)
SCM J (OUT)	Post-Dev 10 yr	10	2.864	731.00	23.1	314.35	1.756
SCM J (IN)	Post-Dev 25 yr	25	5.104	721.00	85.9	(N/A)	(N/A)
SCM J (OUT)	Post-Dev 25 yr	25	3.917	727.00	47.9	314.72	1.945
SCM I (IN)	Post-Dev 1 yr	1	1.127	721.00	24.4	(N/A)	(N/A)
SCM I (OUT)	Post-Dev 1 yr	1	0.153	1,440.00	0.2	321.78	0.974
SCM I (IN)	Post-Dev 10 yr	10	2.525	721.00	45.5	(N/A)	(N/A)
SCM I (OUT)	Post-Dev 10 yr	10	1.476	731.00	13.6	322.38	1.168
SCM I (IN)	Post-Dev 25 yr	25	3.161	721.00	52.8	(N/A)	(N/A)
SCM I (OUT)	Post-Dev 25 yr	25	2.111	728.00	27.1	322.76	1.295
SCM G (IN)	Post-Dev 1 yr	1	2.110	721.00	45.5	(N/A)	(N/A)
SCM G (OUT)	Post-Dev 1 yr	1	0.322	1,440.00	0.4	343.76	1.788
SCM G (IN)	Post-Dev 10 yr	10	4.473	721.00	79.4	(N/A)	(N/A)
SCM G (OUT)	Post-Dev 10 yr	10	2.658	733.00	20.6	344.43	2.175
SCM G (IN)	Post-Dev 25 yr	25	5.532	721.00	90.8	(N/A)	(N/A)
SCM G (OUT)	Post-Dev 25 yr	25	3.713	728.00	41.4	344.84	2.423



AWH-20000 POST  
DCW  
TKD  
1" = 450'  
08.05.2021



POST DEVELOPMENT

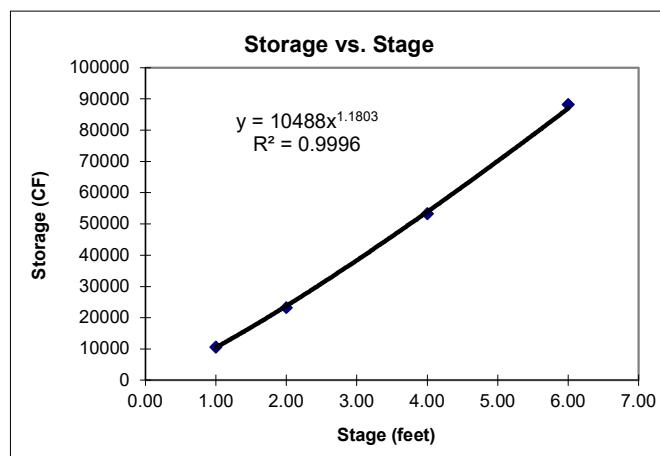
HYDROLOGY MAP

**POST**

*STORMWATER CONTROL MEASURE 'B'*  
*DESIGN CALCULATIONS*

STAGE-STORAGE FUNCTION - ABOVE NORMAL POOL

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
376.00	0.00	9,314				
377.00	1.00	11,965	10640	10640	10640	1.01
378.00	2.00	13,375	12670	12670	23310	1.97
380.00	4.00	16,627	15001	30002	53312	3.97
382.00	6.00	18,355	17491	34982	88294	6.08

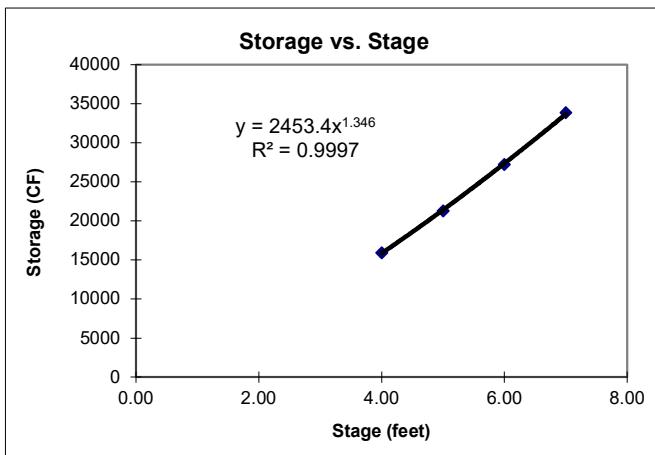


$K_s =$	10488
$b =$	1.1803

**STAGE-STORAGE FUNCTION - MAIN POOL**

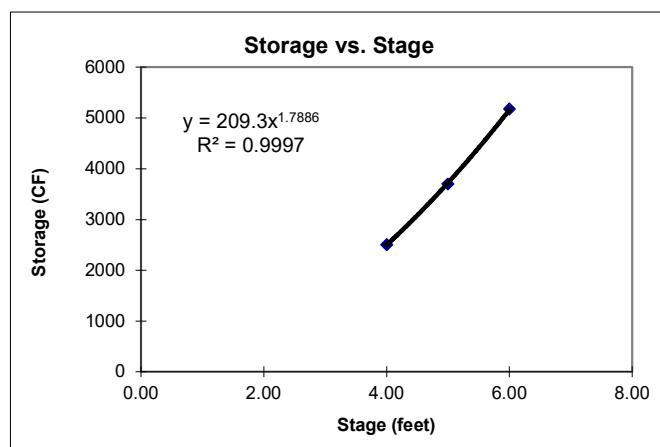
Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
368.50	-0.50	2,669				
369.00	0.00	2,909				
373.00	4.00	5,055	3982	15928	15928	4.01
374.00	5.00	5,654	5355	5355	21283	4.98
375.00	6.00	6,278	5966	5966	27249	5.98
376.00	7.00	6,928	6603	6603	33852	7.03

\*surface area and volume used for avg. depth calculation



STAGE-STORAGE FUNCTION - FOREBAY

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
369.50	-0.50	120				
370.00	0.00	199				
374.00	4.00	1,054	627	2506	2506	4.01
375.00	5.00	1,330	1192	1192	3698	4.98
376.00	6.00	1,632	1481	1481	5179	6.01



$K_s =$	209.3
$b =$	1.7886

**TOTAL VOLUME OF FACILITY**

Volume of Main Pool below Normal Pool= 33,852 cf  
Volume of Forebay below Normal Pool= 5,179 cf  
Total Volume Below Normal Pool = 39,031 cf  
Total Volume Above Normal Pool= 88,294 cf  
Total Volume of Facility = 127,324 cf

**FOREBAY PERCENTAGE OF PERMANENT POOL VOLUME**

*Per NCDEQ Minimum Design Criteria, the forebay volume should equal approximately 15-20% of the main pool volume.*

Total Main Pool Volume = 33,852 cf  
Provided Forebay Volume = 5,179 cf  
Provided Forebay Volume % = 15%

**AVERAGE DEPTH OF MAIN POOL**

Main Pool Volume at Normal Pool = 33,852 cf  
Main Pool Area at Normal Pool = 6,928 sf  
Average Depth = **4.89** ft

**WET DETENTION BASIN SUMMARY**

*Enter the drainage area characteristics ==>*

Total drainage area to pond = 10.26 acres  
Total impervious area to pond = 6.11 acres

Note The basin must be sized to treat all impervious surface runoff draining into the pond, not just the impervious surface from on-site development.

Drainage area = **10.26** acres @ **59.6%** impervious

*Estimate the surface area required at pond normal pool elevation ==>*

Wet Detention Basins are based on an minimum average depth of = **4.89** feet

	4.0	4.89	5.0
Lower Boundary =>	50.0	1.51	1.31
Site % impervious =>	59.6	1.76	1.48
Upper Boundary =>	60.0	1.77	1.49

Therefore, SA/DA required = **1.51**

Surface area required for main pool at normal pool = 6,766 ft<sup>2</sup>  
= 0.16 acres

Surface area provided for total normal pool = 9,314 ft<sup>2</sup>

Surface area provided for main pool at normal pool = 6,928 ft<sup>2</sup>

9134

**DETERMINATION OF WATER QUALITY VOLUME**

$$WQ_V = (P)(R_V)(A)/12$$

where,

$WQ_V$  = water quality volume (in acre-ft)

$R_V = 0.05 + 0.009(I)$  where I is percent impervious cover

A = area in acres

P = rainfall (in inches)

***Input data:***

Total area, A =	10.26	acres
Impervious area =	6.11	acres
Percent impervious cover, I =	59.6	%
Rainfall, P =	1.00	inches

***Calculated values:***

$$\begin{aligned} R_V &= 0.59 \\ WQ_V &= 0.50 \quad \text{acre-ft} \\ &= 21829 \quad \text{cf.} \end{aligned}$$

**ASSOCIATED DEPTH IN POND**

$$WQ_V = 21829 \quad \text{cf.}$$

***Stage / Storage Data:***

$K_s$ =	10488
b =	1.180
$Z_o$ =	376.00
Volume in 1" rainfall =	21829 cf.

***Calculated values:***

Depth of WQv in Basin =	1.86	ft
=	22.33	inches
Elevation =	377.86	ft

**DRAWDOWN ORIFICE DESIGN**

D orifice =	2 inch
# orifices =	1
Ks =	10488
b =	1.1803
C <sub>d</sub> orifice =	0.60
Normal Pool Elevation =	376.00 feet
Volume @ Normal Pool =	0 cf
Orifice Invert =	376.00 feet
WSEL @ 1" Runoff Volume =	377.86 feet

WSEL (feet)	Vol. Stored (cf)	Orifice Flow (cfs)	Avg. Flow (cfs)	Incr. Vol. (cf)	Incr. Time (sec)
377.86	21829	0.140			
377.70	19637	0.133	0.137	2193	16051
377.54	17481	0.127	0.130	2156	16581
377.38	15365	0.120	0.123	2116	17191
377.22	13292	0.112	0.116	2072	17907
377.06	11269	0.104	0.108	2024	18764
376.90	9299	0.095	0.099	1970	19821
376.74	7391	0.085	0.090	1908	21176
376.58	5557	0.074	0.080	1835	23018
376.42	3811	0.061	0.068	1745	25776
376.26	2183	0.045	0.053	1628	30760

Drawdown Time =	2.40 days
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By comparison, if calculated by the average head over the orifice  
(assuming average head is one-third the total depth), the result would be:

Average driving head on orifice =	0.593 feet
Orifice composite loss coefficient =	0.600
Cross-sectional area of siphon =	0.022 sf
Q =	0.0809 cfs

Drawdown Time = Volume / Flowrate / 86400 (sec/day)

Drawdown Time =	3.12 days
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**RISER ANTI-FLOTATION CALCULATION**

*Input Data ==>*

**Safety Factor:**

Safety factor to use = **1.15** (recommend 1.15 or higher)

**Concrete:**

Concrete unit weight = **142.0** PCF      **Note:** NC Products lists unit wt. of manhole concrete at 142 PCF.

**Riser:**

Inside height of Riser = **5.00** feet  
Inside length of riser = **4.00** feet  
Inside width of riser = **4.00** feet  
Wall thickness of riser = **6.00** inches  
Base thickness of riser = **6.00** inches  
Base length of riser = **5.00** feet  
Base width of riser = **5.00** feet

**Openings:**

Total Orifice Area = **4.587** SF  
OD of barrel exiting manhole = **30.00** inches  
Size of drain pipe (if present) = **6.0** inches

**Trash Rack:**

Bottom Length = **7.00** feet  
Bottom Width = **7.00** feet  
Top Length = **1.00** feet  
Top Width = **1.00** feet  
Height = **2.00** feet  
Trash Rack water displacement = **38.00** CF

*Concrete Present in Riser Structure ==>*

*Total amount of concrete:*

Base of Riser = **12.50** CF  
Riser Walls = **45.00** CF

*Adjust for openings:*

Opening for Orifices = **2.29** CF  
Opening for barrel = **2.45** CF  
Opening for drain pipe = **0.10** CF

Total Concrete present, adjusted for openings = **52.654 CF**  
Weight of concrete present = **7,477 lbs**

***Amount of water displaced by Riser Structure ==>***

Displacement by concrete =	52.65 CF
Displacement by open air in riser =	80.00 CF
Displacement by trash rack =	38.00 CF
Total water displaced by riser/barrel structure =	<b>170.65 CF</b>
Weight of water displaced =	<b>10,649 lbs</b>

***Calculate size of base for riser assembly ==>***

Length =	8.00 feet
Width =	8.00 feet
Thickness =	<b>12 inches</b>
Concrete Present =	64.00 CF

***Check validity of base as designed ==>***

Total Water Displaced =	222.15 CF
Total Concrete Present =	116.65 CF
Total Water Displaced =	13,862 lbs
Total Concrete Present =	16,565 lbs
Actual safety factor =	<b>1.19 OK</b>

***Results of design ==>***

Base length =	8.00 feet
Base width =	8.00 feet
Base Thickness =	<b>12.00 inches</b>
CY of concrete total in base =	2.37 CY
Concrete unit weight in added base >=	<b>142.0 PCF</b>

## II. CALCULATION FOR RISER ANTI-FLOTATION STEEL

Input Data ==>

Anti-Floatation Block Length = 8.0 feet  
Anti-Floatation Block Width = 8.0 feet  
Anti-Floatation Block Thickness = 12 inches

$A_{\text{steel}}$  to  $A_{\text{concrete}}$  Ratio = 0.0020 (recommend 0.0018 or higher)

Cross-Section Calculations==>

Cross-Section Area\* = 8.00 SF  
Minimum Steel Area Required = 0.016 SF  
**2.30** SI

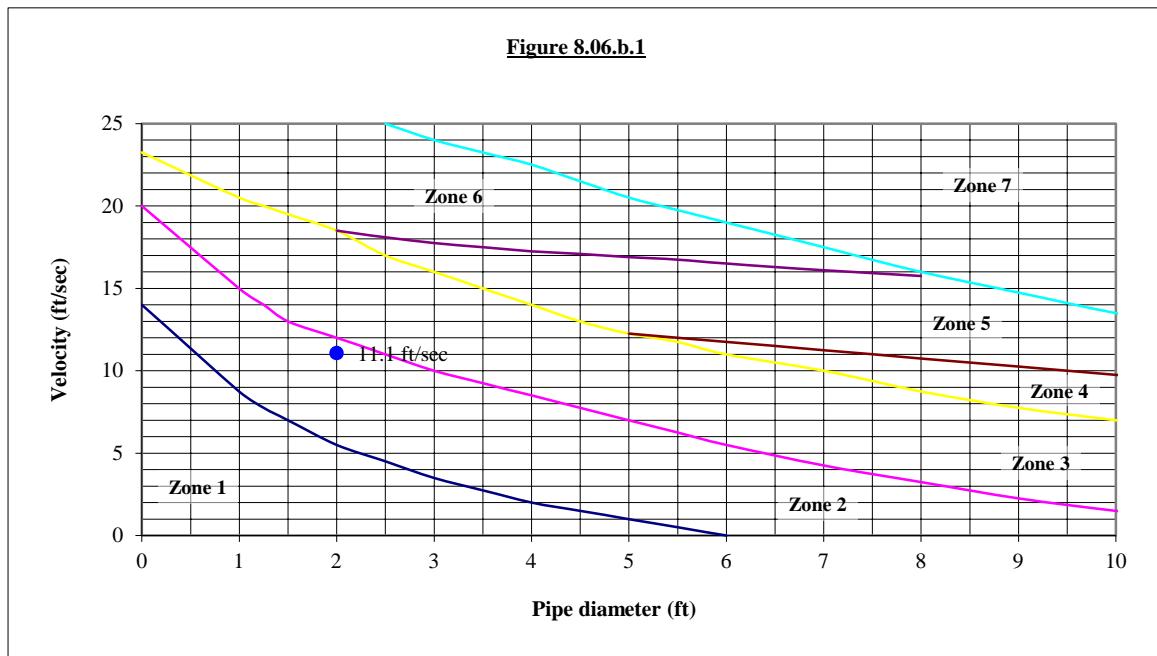
\*Note: Assumes a "square" x-sec (L and W same)

Rebar Calculations ==>

Bar Size	4	5	6	7	8
Diameter (inches)	0.500	0.625	0.750	0.875	1.000
X-Sec Area (SI)	0.196	0.307	0.442	0.601	0.785
Minimum Number of Bars	12	8	6	4	3

### DESIGN OF RIPRAP OUTLET PROTECTION WORKSHEET

Project	<u>The Point</u>	Date	<u>2/23/2022</u>
Project No.	<u>AWH-20000</u>	Designer	<u>TKD</u>
Outlet ID	<u>SCM B</u>		
Flow, $Q_{10\text{-yr}}$	<u>22.8</u> cfs		
Slope, S	<u>2.00</u> %		
Pipe Diameter, $D_o$	<u>24</u> inches		
Pipe Diameter, $D_o$	<u>2.0</u> feet		
Number of pipes	<u>1</u>		
Pipe separation	<u>0</u> feet		
Manning's n	<u>0.013</u>		



Zone from graph above = 2

Outlet pipe diameter <u>24 in.</u>	Length = <u>12.0 ft.</u>
Outlet flowrate <u>22.8 cfs</u>	Width = <u>6.0 ft.</u>
Outlet velocity <u>11.1 ft/sec</u>	Stone diameter = <u>6 in.</u>
Material = <u>Class B</u>	Thickness = <u>22 in.</u>

Zone	Material	Diameter	Thickness	Length	Width
1	Class A	3	9	$4 \times D(o)$	$3 \times D(o)$
2	Class B	6	22	$6 \times D(o)$	$3 \times D(o)$
3	Class I	13	22	$8 \times D(o)$	$3 \times D(o)$
4	Class I	13	22	$8 \times D(o)$	$3 \times D(o)$
5	Class II	23	27	$10 \times D(o)$	$3 \times D(o)$
6	Class II	23	27	$10 \times D(o)$	$3 \times D(o)$
7	Special study required				

1. Calculations based on NY DOT method - Pages 8.06.05 through 8.06.06 in NC Erosion Control Manual
2. Outlet velocity based on full-flow velocity



Subsection: Elevation-Area Volume Curve

Label: SCM B

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

Elevation (ft)	Planimeter (ft <sup>2</sup> )	Area (acres)	A1+A2+sqr (A1*A2) (acres)	Volume (ac-ft)	Volume (Total) (ac-ft)
376.00	0.0	0.21	0.00	0.000	0.000
377.00	0.0	0.27	0.73	0.244	0.244
378.00	0.0	0.31	0.87	0.291	0.534
380.00	0.0	0.38	1.03	0.687	1.222
382.00	0.0	0.42	1.20	0.803	2.024



Subsection: Outlet Input Data

Label: SCMB

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

#### Requested Pond Water Surface Elevations

Minimum (Headwater)	376.00 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	382.00 ft

#### Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Rectangular Weir	Copy of Copy of Weir - 1	Forward	Culvert	379.00	379.50
Rectangular Weir	Copy of Weir - 1	Forward	Culvert	379.00	379.50
Rectangular Weir	Weir - 1	Forward	Culvert	379.00	379.50
Orifice-Area	Orifice - 1yr	Forward	Culvert	379.50	382.00
Inlet Box	Riser	Forward	Culvert	380.00	382.00
Orifice-Circular	WQOrifice	Forward	Culvert	376.00	382.00
Culvert-Circular	Culvert	Forward	TW	375.00	382.00
Tailwater Settings	Tailwater			(N/A)	(N/A)



Subsection: Outlet Input Data

Label: SCMB

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

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Structure ID: Culvert  
Structure Type: Culvert-Circular

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Number of Barrels	1
Diameter	24.00 in
Length	50.00 ft
Length (Computed Barrel)	50.01 ft
Slope (Computed)	0.020 ft/ft

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Outlet Control Data

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Manning's n	0.013
Ke	1
Kb	0
Kr	0
Convergence Tolerance	0.00 ft

---

Inlet Control Data

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Equation Form	Form 1
K	0.0098
M	2.0000
C	0.0398
Y	0.6700
T1 ratio (HW/D)	1
T2 ratio (HW/D)	1
Slope Correction Factor	-1

---

Use unsubmerged inlet 0 equation below T1 elevation.

Use submerged inlet 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,  
interpolate between flows at T1 & T2...

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T1 Elevation	377.30 ft	T1 Flow	15.6 ft <sup>3</sup> /s
T2 Elevation	377.59 ft	T2 Flow	17.8 ft <sup>3</sup> /s

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Subsection: Outlet Input Data

Label: SCMB

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

Structure ID:	Riser
Structure Type:	Inlet Box
Number of Openings	1
Elevation	380.00 ft
Orifice Area	16.0 ft <sup>2</sup>
Orifice Coefficient	1
Weir Length	16.00 ft
Weir Coefficient	3.00 (ft <sup>0.5</sup> )/s
K Reverse	1
Manning's n	0
Kev, Charged Riser	0
Weir Submergence	False
Orifice H to crest	False

Structure ID:	WQOrifice
Structure Type:	Orifice-Circular
Number of Openings	1
Elevation	376.00 ft
Orifice Diameter	2.00 in
Orifice Coefficient	1

Structure ID:	Orifice - 1yr
Structure Type:	Orifice-Area
Number of Openings	3
Elevation	379.00 ft
Orifice Area	1.5 ft <sup>2</sup>
Top Elevation	379.50 ft
Datum Elevation	379.25 ft
Orifice Coefficient	1

Structure ID:	Weir - 1
Structure Type:	Rectangular Weir
Number of Openings	1
Elevation	379.00 ft
Weir Length	3.00 ft
Weir Coefficient	3.00 (ft <sup>0.5</sup> )/s

Structure ID:	Copy of Weir - 1
Structure Type:	Rectangular Weir
Number of Openings	1
Elevation	379.00 ft
Weir Length	3.00 ft
Weir Coefficient	3.00 (ft <sup>0.5</sup> )/s

Structure ID:	Copy of Copy of Weir - 1
Structure Type:	Rectangular Weir
Number of Openings	1
Elevation	379.00 ft



Subsection: Outlet Input Data

Label: SCMB

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

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Structure ID: Copy of Copy of Weir - 1  
Structure Type: Rectangular Weir

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Weir Length 3.00 ft  
Weir Coefficient 3.00 (ft<sup>0.5</sup>)/s

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Structure ID: TW  
Structure Type: TW Setup, DS Channel

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Tailwater Type Free Outfall

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Convergence Tolerances

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Maximum Iterations 30  
Tailwater Tolerance (Minimum) 0.01 ft  
Tailwater Tolerance (Maximum) 0.50 ft  
Headwater Tolerance (Minimum) 0.01 ft  
Headwater Tolerance (Maximum) 0.50 ft  
Flow Tolerance (Minimum) 0.0 ft<sup>3</sup>/s  
Flow Tolerance (Maximum) 10.0 ft<sup>3</sup>/s

---

Subsection: Composite Rating Curve

Label: SCMB

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft <sup>3</sup> /s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
376.00	0.0	(N/A)	0.00	(no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,Riser,WQOrifice,Culvert)
376.10	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,Riser)
376.20	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,Riser)
376.30	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,Riser)
376.40	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,Riser)
376.50	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,Riser)
376.60	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,Riser)
376.70	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,Riser)
376.80	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,Riser)
376.90	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,Riser)
377.00	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,Riser)
377.10	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,Riser)
377.20	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,Riser)

Subsection: Composite Rating Curve

Label: SCMB

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
377.30	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,Riser)
377.40	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,Riser)
377.50	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,Riser)
377.60	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,Riser)
377.70	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,Riser)
377.80	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,Riser)
377.90	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,Riser)
378.00	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,Riser)
378.10	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,Riser)
378.20	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,Riser)
378.30	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,Riser)
378.40	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,Riser)
378.50	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,Riser)



Subsection: Composite Rating Curve

Label: SCMB

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
378.60	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,Riser)
378.70	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,Riser)
378.80	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,Riser)
378.90	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,Riser)
379.00	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,Riser)
379.10	1.0	(N/A)	0.00	Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,WQOrifice,Culvert (no Q: Orifice - 1yr,Riser)
379.20	2.6	(N/A)	0.00	Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,WQOrifice,Culvert (no Q: Orifice - 1yr,Riser)
379.30	4.6	(N/A)	0.00	Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,WQOrifice,Culvert (no Q: Orifice - 1yr,Riser)
379.40	7.0	(N/A)	0.00	Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,WQOrifice,Culvert (no Q: Orifice - 1yr,Riser)
379.50	11.0	(N/A)	0.00	Orifice - 1yr,WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Riser)
379.60	13.0	(N/A)	0.00	Orifice - 1yr,WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Riser)
379.70	14.7	(N/A)	0.00	Orifice - 1yr,WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Riser)

Subsection: Composite Rating Curve

Label: SCMB

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

**Composite Outflow Summary**

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
379.80	16.2	(N/A)	0.00	Orifice - 1yr,WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Riser)
379.90	17.6	(N/A)	0.00	Orifice - 1yr,WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Riser)
380.00	18.9	(N/A)	0.00	Orifice - 1yr,WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Riser)
380.10	21.6	(N/A)	0.00	Orifice - 1yr,Riser,WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1)
380.20	25.5	(N/A)	0.00	Orifice - 1yr,Riser,WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1)
380.30	27.9	(N/A)	0.00	Orifice - 1yr,Riser,WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1)
380.40	29.3	(N/A)	0.00	Orifice - 1yr,Riser,WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1)
380.50	30.6	(N/A)	0.00	Orifice - 1yr,Riser,WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1)
380.60	31.8	(N/A)	0.00	Orifice - 1yr,Riser,WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1)
380.70	32.8	(N/A)	0.00	Orifice - 1yr,Riser,WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1)
380.80	33.3	(N/A)	0.00	Riser,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,WQOrifice)

Subsection: Composite Rating Curve

Label: SCMB

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
380.90	33.7	(N/A)	0.00	Riser,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,WQOrifice)
381.00	34.1	(N/A)	0.00	Riser,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,WQOrifice)
381.10	34.4	(N/A)	0.00	Riser,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,WQOrifice)
381.20	34.8	(N/A)	0.00	Riser,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,WQOrifice)
381.30	35.1	(N/A)	0.00	Riser,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,WQOrifice)
381.40	35.5	(N/A)	0.00	Riser,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,WQOrifice)
381.50	35.8	(N/A)	0.00	Riser,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,WQOrifice)
381.60	36.2	(N/A)	0.00	Riser,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,WQOrifice)
381.70	36.5	(N/A)	0.00	Riser,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,WQOrifice)
381.80	36.9	(N/A)	0.00	Riser,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,WQOrifice)
381.90	37.2	(N/A)	0.00	Riser,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,WQOrifice)
382.00	37.5	(N/A)	0.00	Riser,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice - 1yr,WQOrifice)



Subsection: Level Pool Pond Routing Summary

Label: SCM B (IN)

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

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#### Infiltration

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Infiltration Method (Computed)	No Infiltration
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#### Initial Conditions

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Elevation (Water Surface, Initial)	376.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

---

---

#### Inflow/Outflow Hydrograph Summary

---

Flow (Peak In)	29.9 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	1.1 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	785.00 min

---

Elevation (Water Surface, Peak)	379.11 ft
Volume (Peak)	0.896 ac-ft

---

---

#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	1.382 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.515 ac-ft
Volume (Retained)	0.866 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.0 %

---



Subsection: Level Pool Pond Routing Summary  
Label: SCM B (IN)  
Scenario: Post-Dev 10 yr

Return Event: 10 years  
Storm Event: 10 yr

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#### Infiltration

---

Infiltration Method (Computed)	No Infiltration
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#### Initial Conditions

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Elevation (Water Surface, Initial)	376.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft³/s
Flow (Initial Infiltration)	0.0 ft³/s
Flow (Initial, Total)	0.0 ft³/s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	55.8 ft³/s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	22.8 ft³/s	Time to Peak (Flow, Outlet)	729.00 min

---

Elevation (Water Surface, Peak)	380.13 ft
Volume (Peak)	1.271 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	3.095 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	2.215 ac-ft
Volume (Retained)	0.879 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

---



Subsection: Level Pool Pond Routing Summary

Label: SCM B (IN)

Scenario: Post-Dev 25 yr

Return Event: 25 years

Storm Event: 25 yr

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#### Infiltration

---

Infiltration Method (Computed)	No Infiltration
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---

#### Initial Conditions

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Elevation (Water Surface, Initial)	376.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	64.7 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	31.6 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	728.00 min

---

Elevation (Water Surface, Peak)	380.58 ft
Volume (Peak)	1.448 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	3.875 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	2.991 ac-ft
Volume (Retained)	0.883 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

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Subsection: Level Pool Pond Routing Summary

Label: SCM B (IN)

Scenario: Post-Dev 100 yr

Return Event: 100 years

Storm Event: 100 yr

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#### Infiltration

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Infiltration Method (Computed)	No Infiltration
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#### Initial Conditions

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Elevation (Water Surface, Initial)	376.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	77.5 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	34.8 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	729.00 min

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Elevation (Water Surface, Peak)	381.20 ft
Volume (Peak)	1.693 ac-ft

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#### Mass Balance (ac-ft)

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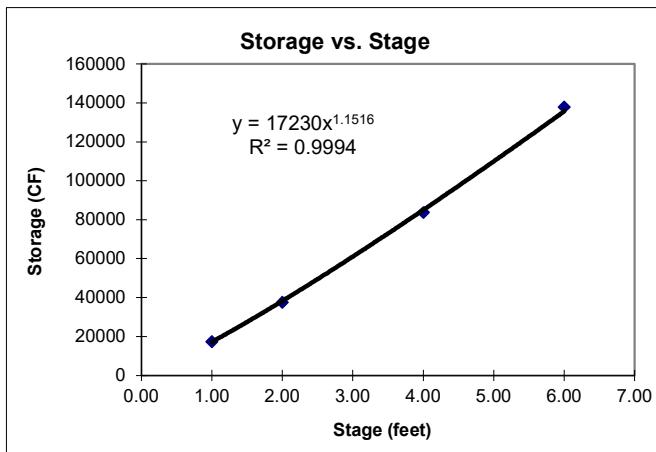
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	5.179 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	4.294 ac-ft
Volume (Retained)	0.884 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

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*STORMWATER CONTROL MEASURE 'G'*  
*DESIGN CALCULATIONS*

**STAGE-STORAGE FUNCTION - ABOVE NORMAL POOL**

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
340.00	0.00	15,673				
341.00	1.00	19,251	17462	17462	17462	1.01
342.00	2.00	21,125	20188	20188	37650	1.97
344.00	4.00	25,043	23084	46168	83818	3.95
346.00	6.00	29,187	27115	54230	138048	6.09

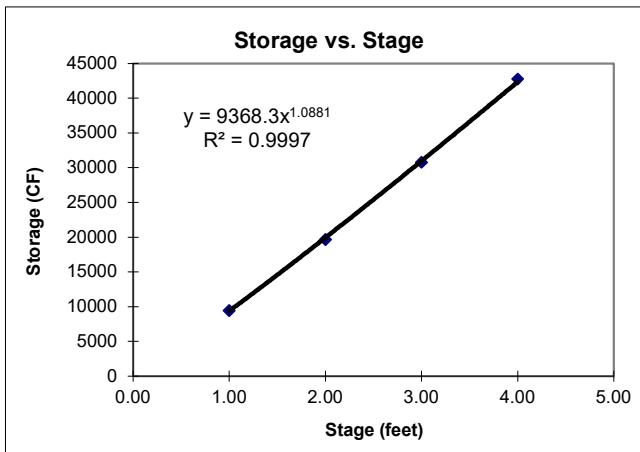


$K_s =$	17230
$b =$	1.1516

**STAGE-STORAGE FUNCTION - MAIN POOL**

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
335.00	-1.00	8,242				
336.00	0.00	9,028				
337.00	1.00	9,838	9433	9433	9433	1.01
338.00	2.00	10,674	10256	10256	19689	1.98
339.00	3.00	11,535	11105	11105	30794	2.98
340.00	4.00	12,421	11978	11978	42772	4.04

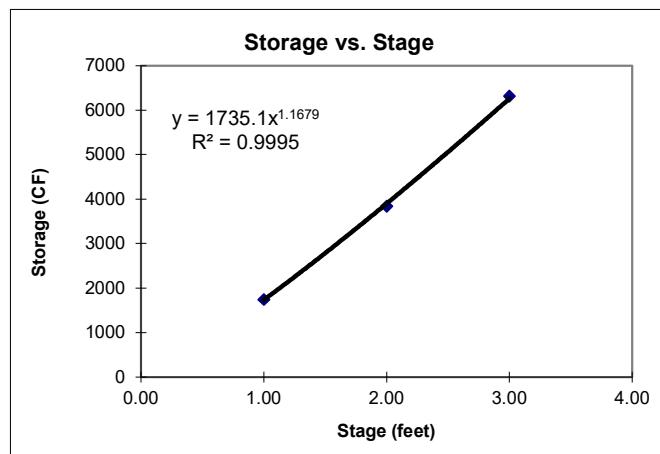
\*surface area and volume used for avg. depth calculation



$K_s =$	9368
$b =$	1.0881

**STAGE-STORAGE FUNCTION - FOREBAY**

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
336.00	-1.00	1,259				
337.00	0.00	1,574				Sediment Storage
338.00	1.00	1,915	1745	1745	1745	1.00
339.00	2.00	2,280	2098	2098	3842	1.98
340.00	3.00	2,671	2476	2476	6318	3.02



$K_s =$	1735.1
$b =$	1.1679

**TOTAL VOLUME OF FACILITY**

Volume of Main Pool below Normal Pool= 42,772 cf  
Volume of Forebay below Normal Pool= 6,318 cf  
Total Volume Below Normal Pool = 49,089 cf  
Total Volume Above Normal Pool= 138,048 cf  
Total Volume of Facility = 187,137 cf

**FOREBAY PERCENTAGE OF PERMANENT POOL VOLUME**

*Per NCDEQ Minimum Design Criteria, the forebay volume should equal approximately 15-20% of the main pool volume.*

Total Main Pool Volume = 42,772 cf  
Provided Forebay Volume = 6,318 cf  
Provided Forebay Volume % = 15%

**AVERAGE DEPTH OF MAIN POOL**

Main Pool Volume at Normal Pool = 42,772 cf  
Main Pool Area at Normal Pool = 12,421 sf  
Average Depth = **3.44** ft

**WET DETENTION BASIN SUMMARY**

*Enter the drainage area characteristics ==>*

Total drainage area to pond = 13.66 acres  
Total impervious area to pond = 8.16 acres

Note The basin must be sized to treat all impervious surface runoff draining into the pond, not just the impervious surface from on-site development.

Drainage area = **13.66** acres @ **59.8%** impervious

*Estimate the surface area required at pond normal pool elevation ==>*

Wet Detention Basins are based on an minimum average depth of = **3.44** feet

	3.0	3.44	4.0
Lower Boundary =>	50.0	1.79	1.51
Site % impervious =>	59.8	2.08	1.76
Upper Boundary =>	60.0	2.09	1.77

Therefore, SA/DA required = **1.94**

Surface area required for main pool at normal pool = 11,552 ft<sup>2</sup>

= 0.27 acres

Surface area provided for total normal pool = 15,673 ft<sup>2</sup>

Surface area provided for main pool at normal pool = 12,421 ft<sup>2</sup>

**DETERMINATION OF WATER QUALITY VOLUME**

$$WQ_V = (P)(R_V)(A)/12$$

where,

$WQ_V$  = water quality volume (in acre-ft)

$R_V = 0.05 + 0.009(I)$  where I is percent impervious cover

A = area in acres

P = rainfall (in inches)

***Input data:***

Total area, A =	13.66	acres
Impervious area =	8.16	acres
Percent impervious cover, I =	59.8	%
Rainfall, P =	1.00	inches

***Calculated values:***

$$\begin{aligned} R_V &= 0.59 \\ WQ_V &= 0.67 \quad \text{acre-ft} \\ &= 29149 \quad \text{cf.} \end{aligned}$$

**ASSOCIATED DEPTH IN POND**

$$WQ_V = 29149 \quad \text{cf.}$$

***Stage / Storage Data:***

$K_s$ =	17230
b =	1.152
$Z_o$ =	340.00
Volume in 1" rainfall =	29149 cf.

***Calculated values:***

Depth of WQv in Basin =	1.58	ft
=	18.94	inches
Elevation =	341.58	ft

**DRAWDOWN ORIFICE DESIGN**

D orifice =	2.5 inch
# orifices =	1
Ks =	17230
b =	1.1516
C <sub>d</sub> orifice =	0.60
Normal Pool Elevation =	340.00 feet
Volume @ Normal Pool =	0 cf
Orifice Invert =	340.00 feet
WSEL @ 1" Runoff Volume =	341.58 feet

WSEL (feet)	Vol. Stored (cf)	Orifice Flow (cfs)	Avg. Flow (cfs)	Incr. Vol. (cf)	Incr. Time (sec)
341.58	29149	0.199			
341.44	26267	0.190	0.194	2883	14839
341.31	23425	0.180	0.185	2842	15394
341.17	20628	0.169	0.174	2797	16040
341.03	17880	0.158	0.164	2748	16804
340.90	15187	0.146	0.152	2693	17732
340.76	12556	0.133	0.139	2631	18895
340.62	9995	0.118	0.125	2560	20421
340.49	7519	0.101	0.110	2476	22569
340.35	5147	0.081	0.091	2372	25970
340.21	2915	0.054	0.068	2232	32940

Drawdown Time =	2.33 days
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By comparison, if calculated by the average head over the orifice  
(assuming average head is one-third the total depth), the result would be:

Average driving head on orifice =	0.492 feet
Orifice composite loss coefficient =	0.600
Cross-sectional area of siphon =	0.034 sf
Q =	0.1151 cfs

Drawdown Time = Volume / Flowrate / 86400 (sec/day)

Drawdown Time =	2.93 days
-----------------	-----------

**RISER ANTI-FLOTATION CALCULATION**

**Input Data ==>**

**Safety Factor:**

Safety factor to use = **1.15** (recommend 1.15 or higher)

**Concrete:**

Concrete unit weight = **142.0** PCF      **Note:** NC Products lists unit wt. of manhole concrete at 142 PCF.

**Riser:**

Inside height of Riser = **5.50** feet  
Inside length of riser = **5.00** feet  
Inside width of riser = **5.00** feet  
Wall thickness of riser = **6.00** inches  
Base thickness of riser = **6.00** inches  
Base length of riser = **6.00** feet  
Base width of riser = **6.00** feet

**Openings:**

Total Orifice Area = **15.087** SF  
OD of barrel exiting manhole = **44.00** inches  
Size of drain pipe (if present) = **6.0** inches

**Trash Rack:**

Bottom Length = **8.40** feet  
Bottom Width = **8.40** feet  
Top Length = **2.10** feet  
Top Width = **2.10** feet  
Height = **2.00** feet  
Trash Rack water displacement = **61.74** CF

**Concrete Present in Riser Structure ==>**

**Total amount of concrete:**

Base of Riser = **18.00** CF  
Riser Walls = **60.50** CF

**Adjust for openings:**

Opening for Orifices = **7.54** CF  
Opening for barrel = **5.28** CF  
Opening for drain pipe = **0.10** CF

Total Concrete present, adjusted for openings = **65.579** CF  
Weight of concrete present = **9,312 lbs**

***Amount of water displaced by Riser Structure ==>***

Displacement by concrete =	65.58 CF
Displacement by open air in riser =	137.50 CF
Displacement by trash rack =	61.74 CF
Total water displaced by riser/barrel structure =	<b>264.82 CF</b>
Weight of water displaced =	<b>16,525 lbs</b>

***Calculate size of base for riser assembly ==>***

Length =	9.00 feet
Width =	9.00 feet
Thickness =	<b>18 inches</b>
Concrete Present =	121.50 CF

***Check validity of base as designed ==>***

Total Water Displaced =	368.32 CF
Total Concrete Present =	187.08 CF
Total Water Displaced =	22,983 lbs
Total Concrete Present =	26,565 lbs
Actual safety factor =	<b>1.16 OK</b>

***Results of design ==>***

Base length =	9.00 feet
Base width =	9.00 feet
Base Thickness =	18.00 inches
CY of concrete total in base =	4.50 CY
Concrete unit weight in added base >=	142.0 PCF

## II. CALCULATION FOR RISER ANTI-FLOTATION STEEL

Input Data ==>

Anti-Floatation Block Length = 9.0 feet  
Anti-Floatation Block Width = 9.0 feet  
Anti-Floatation Block Thickness = 18 inches

$A_{\text{steel}}$  to  $A_{\text{concrete}}$  Ratio = 0.0020 (recommend 0.0018 or higher)

Cross-Section Calculations==>

Cross-Section Area\* = 13.50 SF  
Minimum Steel Area Required = 0.027 SF  
**3.89** SI

\*Note: Assumes a "square" x-sec (L and W same)

Rebar Calculations ==>

Bar Size	4	5	6	7	8
Diameter (inches)	0.500	0.625	0.750	0.875	1.000
X-Sec Area (SI)	0.196	0.307	0.442	0.601	0.785
Minlimum Number of Bars	20	13	9	7	5

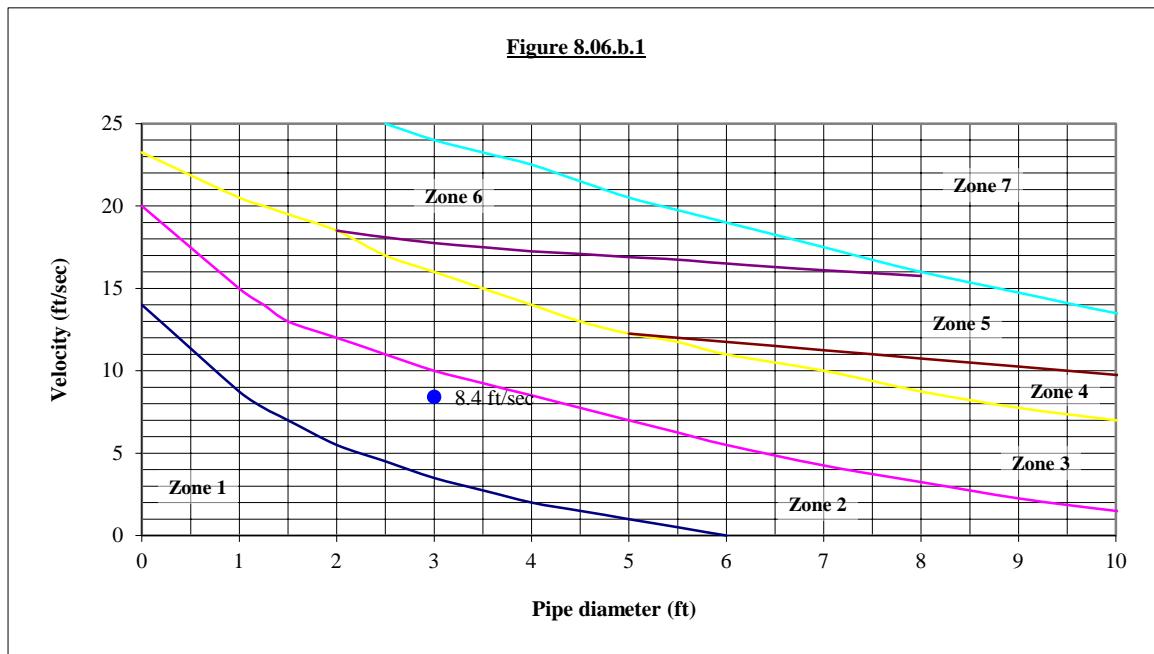
## DESIGN OF RIPRAP OUTLET PROTECTION WORKSHEET

Project  
Project No.  
Outlet ID

The Point  
AWH-20000  
SCM G

Date 2/23/2022  
Designer TKD

Flow,  $Q_{10\text{-yr}}$  20.6 cfs  
Slope,  $S$  1.03 %  
Pipe Diameter,  $D_o$  36 inches  
Pipe Diameter,  $D_o$  3.0 feet  
Number of pipes 1  
Pipe separation 0 feet  
Manning's  $n$  0.013



Zone from graph above = 2

Outlet pipe diameter	<u>36 in.</u>	Length =	<u>18.0 ft.</u>
Outlet flowrate	<u>20.6 cfs</u>	Width =	<u>9.0 ft.</u>
Outlet velocity	<u>8.4 ft/sec</u>	Stone diameter =	<u>6 in.</u>
Material =	<u>Class B</u>	Thickness =	<u>22 in.</u>

Zone	Material	Diameter	Thickness	Length	Width
1	Class A	3	9	$4 \times D(o)$	$3 \times D(o)$
2	Class B	6	22	$6 \times D(o)$	$3 \times D(o)$
3	Class I	13	22	$8 \times D(o)$	$3 \times D(o)$
4	Class I	13	22	$8 \times D(o)$	$3 \times D(o)$
5	Class II	23	27	$10 \times D(o)$	$3 \times D(o)$
6	Class II	23	27	$10 \times D(o)$	$3 \times D(o)$
7	Special study required				

1. Calculations based on NY DOT method - Pages 8.06.05 through 8.06.06 in NC Erosion Control Manual
2. Outlet velocity based on full-flow velocity



Subsection: Elevation-Area Volume Curve

Label: SCM G

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

Elevation (ft)	Planimeter (ft <sup>2</sup> )	Area (acres)	A1+A2+sqr (A1*A2) (acres)	Volume (ac-ft)	Volume (Total) (ac-ft)
340.00	0.0	0.36	0.00	0.000	0.000
341.00	0.0	0.44	1.20	0.400	0.400
342.00	0.0	0.48	1.39	0.463	0.863
344.00	0.0	0.57	1.59	1.059	1.922
346.00	0.0	0.67	1.87	1.244	3.166



Subsection: Outlet Input Data

Label: SCMG

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

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Requested Pond Water Surface Elevations

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Minimum (Headwater)	340.00 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	346.00 ft

---

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Rectangular Weir	Weir - 1yr	Forward	Culvert	343.75	346.00
Inlet Box	Riser	Forward	Culvert	345.00	346.00
Orifice-Circular	WQOrifice	Forward	Culvert	340.00	346.00
Culvert-Circular	Culvert	Forward	TW	339.50	346.00
Tailwater Settings	Tailwater			(N/A)	(N/A)



Subsection: Outlet Input Data

Label: SCMG

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

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Structure ID: Culvert  
Structure Type: Culvert-Circular

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Number of Barrels	1
Diameter	36.00 in
Length	48.50 ft
Length (Computed Barrel)	48.50 ft
Slope (Computed)	0.010 ft/ft

---

Outlet Control Data

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Manning's n	0.013
Ke	1
Kb	0
Kr	0
Convergence Tolerance	0.00 ft

---

Inlet Control Data

---

Equation Form	Form 1
K	0.0098
M	2.0000
C	0.0398
Y	0.6700
T1 ratio (HW/D)	1
T2 ratio (HW/D)	1
Slope Correction Factor	-1

---

Use unsubmerged inlet 0 equation below T1 elevation.

Use submerged inlet 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,  
interpolate between flows at T1 & T2...

---

T1 Elevation	342.97 ft	T1 Flow	42.9 ft <sup>3</sup> /s
T2 Elevation	343.40 ft	T2 Flow	49.0 ft <sup>3</sup> /s

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Subsection: Outlet Input Data

Label: SCMG

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

Structure ID: Riser	
Structure Type: Inlet Box	
Number of Openings	1
Elevation	345.00 ft
Orifice Area	25.0 ft <sup>2</sup>
Orifice Coefficient	1
Weir Length	8.00 ft
Weir Coefficient	3.00 (ft <sup>0.5</sup> )/s
K Reverse	1
Manning's n	0
Kev, Charged Riser	0
Weir Submergence	False
Orifice H to crest	False

Structure ID: WQOrifice	
Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	340.00 ft
Orifice Diameter	2.50 in
Orifice Coefficient	1

Structure ID: Weir - 1yr	
Structure Type: Rectangular Weir	
Number of Openings	1
Elevation	343.75 ft
Weir Length	12.00 ft
Weir Coefficient	3.00 (ft <sup>0.5</sup> )/s

Structure ID: TW	
Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall

Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.0 ft <sup>3</sup> /s
Flow Tolerance (Maximum)	10.0 ft <sup>3</sup> /s



Subsection: Composite Rating Curve

Label: SCMG

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
340.00	0.0	(N/A)	0.00	(no Q: Weir - 1yr,Riser,WQOrifice,Culvert)
340.10	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
340.20	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
340.30	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
340.40	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
340.50	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
340.60	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
340.70	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
340.80	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
340.90	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
341.00	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
341.10	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
341.20	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
341.30	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
341.40	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
341.50	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
341.60	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
341.70	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
341.80	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
341.90	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
342.00	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
342.10	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
342.20	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
342.30	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
342.40	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)



Subsection: Composite Rating Curve

Label: SCMG

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
342.50	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
342.60	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
342.70	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
342.80	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
342.90	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
343.00	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
343.10	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
343.20	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
343.30	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
343.40	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
343.50	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
343.60	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
343.70	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
343.75	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1yr,Riser)
343.80	0.7	(N/A)	0.00	Weir - 1yr,WQOrifice,Culvert (no Q: Riser)
343.90	2.4	(N/A)	0.00	Weir - 1yr,WQOrifice,Culvert (no Q: Riser)
344.00	4.8	(N/A)	0.00	Weir - 1yr,WQOrifice,Culvert (no Q: Riser)
344.10	7.8	(N/A)	0.00	Weir - 1yr,WQOrifice,Culvert (no Q: Riser)
344.20	11.2	(N/A)	0.00	Weir - 1yr,WQOrifice,Culvert (no Q: Riser)
344.30	15.0	(N/A)	0.00	Weir - 1yr,WQOrifice,Culvert (no Q: Riser)
344.40	19.1	(N/A)	0.00	Weir - 1yr,WQOrifice,Culvert (no Q: Riser)
344.50	23.6	(N/A)	0.00	Weir - 1yr,WQOrifice,Culvert (no Q: Riser)



Subsection: Composite Rating Curve

Label: SCMG

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
344.60	28.4	(N/A)	0.00	Weir - 1yr,WQOrifice,Culvert (no Q: Riser)
344.70	33.6	(N/A)	0.00	Weir - 1yr,WQOrifice,Culvert (no Q: Riser)
344.80	38.9	(N/A)	0.00	Weir - 1yr,WQOrifice,Culvert (no Q: Riser)
344.90	44.6	(N/A)	0.00	Weir - 1yr,WQOrifice,Culvert (no Q: Riser)
345.00	50.5	(N/A)	0.00	Weir - 1yr,WQOrifice,Culvert (no Q: Riser)
345.10	55.8	(N/A)	0.00	Weir - 1yr,Riser,WQOrifice,Culvert
345.20	59.2	(N/A)	0.00	Weir - 1yr,Riser,WQOrifice,Culvert
345.30	62.0	(N/A)	0.00	Weir - 1yr,Riser,WQOrifice,Culvert
345.40	64.3	(N/A)	0.00	Weir - 1yr,Riser,WQOrifice,Culvert
345.50	66.4	(N/A)	0.00	Weir - 1yr,Riser,WQOrifice,Culvert
345.60	68.3	(N/A)	0.00	Weir - 1yr,Riser,WQOrifice,Culvert
345.70	69.9	(N/A)	0.00	Weir - 1yr,Riser,WQOrifice,Culvert
345.80	71.4	(N/A)	0.00	Weir - 1yr,Riser,WQOrifice,Culvert
345.90	72.7	(N/A)	0.00	Weir - 1yr,Riser,WQOrifice,Culvert
346.00	73.9	(N/A)	0.00	Weir - 1yr,Riser,WQOrifice,Culvert



Subsection: Level Pool Pond Routing Summary

Label: SCM G (IN)

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

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#### Infiltration

---

Infiltration Method (Computed)	No Infiltration
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#### Initial Conditions

---

Elevation (Water Surface, Initial)	340.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

---

---

#### Inflow/Outflow Hydrograph Summary

---

Flow (Peak In)	45.5 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	0.4 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	1,440.00 min

---

Elevation (Water Surface, Peak)	343.76 ft
Volume (Peak)	1.788 ac-ft

---

---

#### Mass Balance (ac-ft)

---

Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	2.110 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.322 ac-ft
Volume (Retained)	1.787 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

---



Subsection: Level Pool Pond Routing Summary

Label: SCM G (IN)

Scenario: Post-Dev 10 yr

Return Event: 10 years

Storm Event: 10 yr

---

#### Infiltration

---

Infiltration Method (Computed)	No Infiltration
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---

---

#### Initial Conditions

---

Elevation (Water Surface, Initial)	340.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

---

Flow (Peak In)	79.4 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	20.6 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	733.00 min

---

Elevation (Water Surface, Peak)	344.43 ft
Volume (Peak)	2.175 ac-ft

---

---

#### Mass Balance (ac-ft)

---

Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	4.473 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	2.658 ac-ft
Volume (Retained)	1.814 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

---



Subsection: Level Pool Pond Routing Summary  
Label: SCM G (IN)  
Scenario: Post-Dev 25 yr

Return Event: 25 years  
Storm Event: 25 yr

---

#### Infiltration

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Infiltration Method (Computed)	No Infiltration
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#### Initial Conditions

---

Elevation (Water Surface, Initial)	340.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft³/s
Flow (Initial Infiltration)	0.0 ft³/s
Flow (Initial, Total)	0.0 ft³/s
Time Increment	1.00 min

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---

#### Inflow/Outflow Hydrograph Summary

---

Flow (Peak In)	90.8 ft³/s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	41.4 ft³/s	Time to Peak (Flow, Outlet)	728.00 min

---

Elevation (Water Surface, Peak)	344.84 ft
Volume (Peak)	2.423 ac-ft

---

---

#### Mass Balance (ac-ft)

---

Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	5.532 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	3.713 ac-ft
Volume (Retained)	1.818 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

---



Subsection: Level Pool Pond Routing Summary

Label: SCM G (IN)

Scenario: Post-Dev 100 yr

Return Event: 100 years

Storm Event: 100 yr

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#### Infiltration

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Infiltration Method (Computed)	No Infiltration
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#### Initial Conditions

---

Elevation (Water Surface, Initial)	340.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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---

#### Inflow/Outflow Hydrograph Summary

---

Flow (Peak In)	107.2 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	62.8 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	727.00 min

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Elevation (Water Surface, Peak)	345.33 ft
Volume (Peak)	2.730 ac-ft

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#### Mass Balance (ac-ft)

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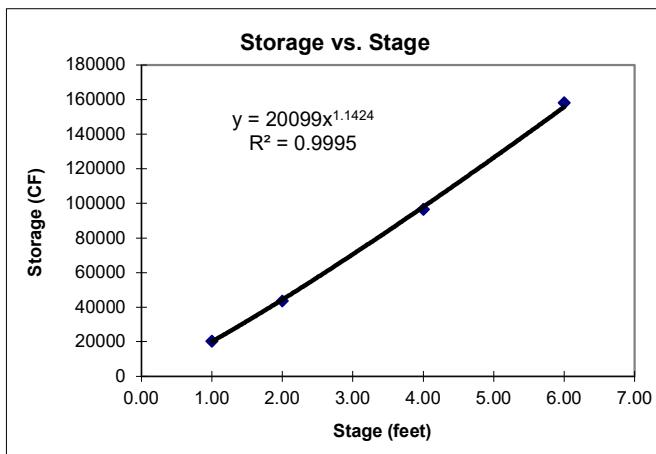
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	7.293 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	5.473 ac-ft
Volume (Retained)	1.819 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

---

*STORMWATER CONTROL MEASURE 'H'*  
*DESIGN CALCULATIONS*

STAGE-STORAGE FUNCTION - ABOVE NORMAL POOL

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
330.00	0.00	18,403				
331.00	1.00	22,307	20355	20355	20355	1.01
332.00	2.00	24,345	23326	23326	43681	1.97
334.00	4.00	28,589	26467	52934	96615	3.95
336.00	6.00	33,059	30824	61648	158263	6.09

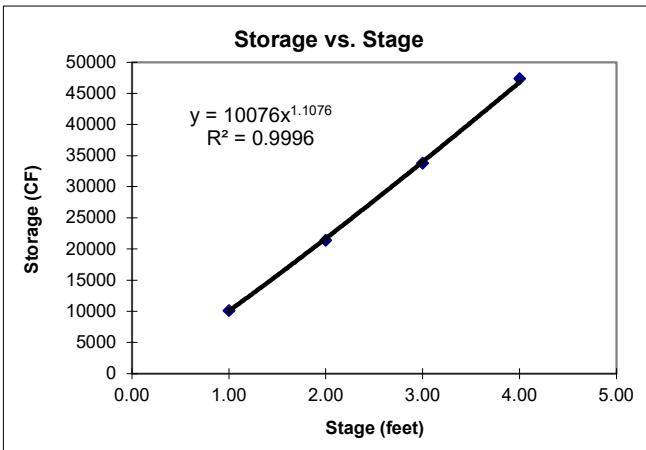


$K_s =$	20099
$b =$	1.1424

**STAGE-STORAGE FUNCTION - MAIN POOL**

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
325.00	-1.00	8,549				
326.00	0.00	9,614				
327.00	1.00	10,703	10159	10159	10159	1.01
328.00	2.00	11,818	11261	11261	21419	1.98
329.00	3.00	12,958	12388	12388	33807	2.98
330.00	4.00	14,123	13541	13541	47348	4.04

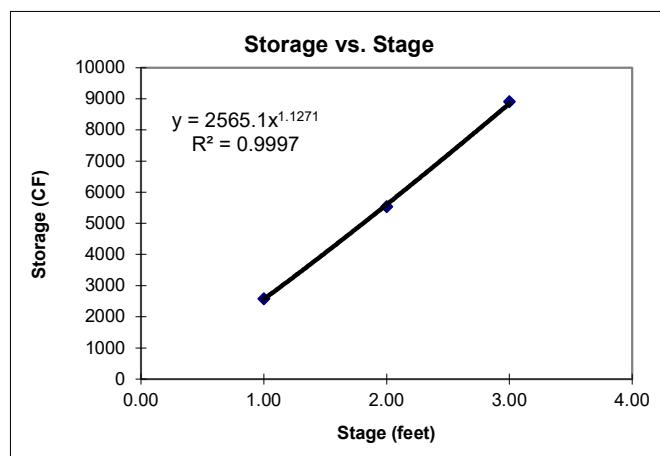
\*surface area and volume used for avg. depth calculation



$K_S =$	10076
$b =$	1.1076

STAGE-STORAGE FUNCTION - FOREBAY

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
326.00	-1.00	2,040				
327.00	0.00	2,389				
328.00	1.00	2,763	2576	2576	2576	1.00
329.00	2.00	3,162	2963	2963	5539	1.98
330.00	3.00	3,586	3374	3374	8913	3.02



$K_s =$	2565.1
$b =$	1.1271

**TOTAL VOLUME OF FACILITY**

Volume of Main Pool below Normal Pool= 47,348 cf  
Volume of Forebay below Normal Pool= 8,913 cf  
Total Volume Below Normal Pool = 56,260 cf  
Total Volume Above Normal Pool= 158,263 cf  
Total Volume of Facility = 214,523 cf

**FOREBAY PERCENTAGE OF PERMANENT POOL VOLUME**

*Per NCDEQ Minimum Design Criteria, the forebay volume should equal approximately 15-20% of the main pool volume.*

Total Main Pool Volume = 47,348 cf  
Provided Forebay Volume = 8,913 cf  
Provided Forebay Volume % = 19%

**AVERAGE DEPTH OF MAIN POOL**

Main Pool Volume at Normal Pool = 47,348 cf  
Main Pool Area at Normal Pool = 14,123 sf  
Average Depth = **3.35** ft

**WET DETENTION BASIN SUMMARY**

*Enter the drainage area characteristics ==>*

Total drainage area to pond = 16.40 acres  
Total impervious area to pond = 9.15 acres

Note The basin must be sized to treat all impervious surface runoff draining into the pond, not just the impervious surface from on-site development.

Drainage area = **16.40** acres @ **55.8%** impervious

*Estimate the surface area required at pond normal pool elevation ==>*

Wet Detention Basins are based on an minimum average depth of = **3.35** feet

	3.0	3.35	4.0
Lower Boundary =>	50.0	1.79	1.51
Site % impervious =>	55.8	1.96	1.66
Upper Boundary =>	60.0	2.09	1.77

Therefore, SA/DA required = **1.86**

Surface area required for main pool at normal pool = 13,269 ft<sup>2</sup>  
= 0.30 acres

Surface area provided for total normal pool = 18,403 ft<sup>2</sup>

Surface area provided for main pool at normal pool = 14,123 ft<sup>2</sup>

**DETERMINATION OF WATER QUALITY VOLUME**

$$WQ_V = (P)(R_V)(A)/12$$

where,

$WQ_V$  = water quality volume (in acre-ft)

$R_V = 0.05 + 0.009(I)$  where I is percent impervious cover

A = area in acres

P = rainfall (in inches)

***Input data:***

Total area, A =	16.40	acres
Impervious area =	9.15	acres
Percent impervious cover, I =	55.8	%
Rainfall, P =	1.00	inches

***Calculated values:***

$$\begin{aligned} R_V &= 0.55 \\ WQ_V &= 0.75 \quad \text{acre-ft} \\ &= 32877 \quad \text{cf.} \end{aligned}$$

**ASSOCIATED DEPTH IN POND**

$$WQ_V = 32877 \quad \text{cf.}$$

***Stage / Storage Data:***

$K_s$ =	20099
b =	1.142
$Z_o$ =	330.00
Volume in 1" rainfall =	32877 cf.

***Calculated values:***

Depth of WQv in Basin =	1.54	ft
=	18.46	inches
Elevation =	331.54	ft

**DRAWDOWN ORIFICE DESIGN**

D orifice =	2.75 inch
# orifices =	1
Ks =	20099
b =	1.1424
C <sub>d</sub> orifice =	0.60
Normal Pool Elevation =	330.00 feet
Volume @ Normal Pool =	0 cf
Orifice Invert =	330.00 feet
WSEL @ 1" Runoff Volume =	331.54 feet

WSEL (feet)	Vol. Stored (cf)	Orifice Flow (cfs)	Avg. Flow (cfs)	Incr. Vol. (cf)	Incr. Time (sec)
331.54	32877	0.237			
331.41	29643	0.225	0.231	3235	14008
331.27	26451	0.213	0.219	3191	14554
331.14	23307	0.201	0.207	3144	15191
331.01	20215	0.187	0.194	3092	15948
330.87	17181	0.173	0.180	3034	16871
330.74	14213	0.157	0.165	2968	18036
330.61	11321	0.139	0.148	2892	19578
330.47	8518	0.118	0.129	2802	21778
330.34	5828	0.094	0.106	2690	25346
330.21	3288	0.057	0.075	2540	33692

Drawdown Time =	2.26 days
-----------------	-----------

By comparison, if calculated by the average head over the orifice  
(assuming average head is one-third the total depth), the result would be:

Average driving head on orifice =	0.475 feet
Orifice composite loss coefficient =	0.600
Cross-sectional area of siphon =	0.041 sf
Q =	0.1368 cfs

Drawdown Time = Volume / Flowrate / 86400 (sec/day)

Drawdown Time =	2.78 days
-----------------	-----------

**RISER ANTI-FLOTATION CALCULATION**

**Input Data ==>**

**Safety Factor:**

Safety factor to use = **1.15** (recommend 1.15 or higher)

**Concrete:**

Concrete unit weight = **142.0** PCF      **Note:** NC Products lists unit wt. of manhole concrete at 142 PCF.

**Riser:**

Inside height of Riser = **5.50** feet  
Inside length of riser = **6.00** feet  
Inside width of riser = **6.00** feet  
Wall thickness of riser = **6.00** inches  
Base thickness of riser = **6.00** inches  
Base length of riser = **7.00** feet  
Base width of riser = **7.00** feet

**Openings:**

Total Orifice Area = **7.665** SF  
OD of barrel exiting manhole = **51.00** inches  
Size of drain pipe (if present) = **6.0** inches

**Trash Rack:**

Bottom Length = **7.00** feet  
Bottom Width = **7.00** feet  
Top Length = **1.00** feet  
Top Width = **1.00** feet  
Height = **2.00** feet  
Trash Rack water displacement = **38.00** CF

**Concrete Present in Riser Structure ==>**

**Total amount of concrete:**

Base of Riser = **24.50** CF  
Riser Walls = **71.50** CF

**Adjust for openings:**

Opening for Orifices = **3.83** CF  
Opening for barrel = **7.09** CF  
Opening for drain pipe = **0.10** CF

Total Concrete present, adjusted for openings = **84.976** CF  
Weight of concrete present = **12,067 lbs**

***Amount of water displaced by Riser Structure ==>***

Displacement by concrete =	84.98 CF
Displacement by open air in riser =	198.00 CF
Displacement by trash rack =	38.00 CF
Total water displaced by riser/barrel structure =	<b>320.98 CF</b>
Weight of water displaced =	<b>20,029 lbs</b>

***Calculate size of base for riser assembly ==>***

Length =	10.00 feet
Width =	10.00 feet
Thickness =	24 inches
Concrete Present =	200.00 CF

Total Water Displaced = 496.48 CF  
Total Concrete Present = 284.98 CF

Total Water Displaced = 30,980 lbs  
Total Concrete Present = 40,467 lbs

Actual safety factor = 1.31 **OK**

***Results of design ==>***

Base length =	10.00 feet
Base width =	10.00 feet
Base Thickness =	24.00 inches
CY of concrete total in base =	7.41 CY
Concrete unit weight in added base >=	142.0 PCF

## II. CALCULATION FOR RISER ANTI-FLOTATION STEEL

Input Data ==>

Anti-Floatation Block Length = 10.0 feet  
Anti-Floatation Block Width = 10.0 feet  
Anti-Floatation Block Thickness = 24 inches

$A_{\text{steel}}$  to  $A_{\text{concrete}}$  Ratio = 0.0020 (recommend 0.0018 or higher)

Cross-Section Calculations==>

Cross-Section Area\* = 20.00 SF  
Minimum Steel Area Required = 0.040 SF  
**5.76** SI

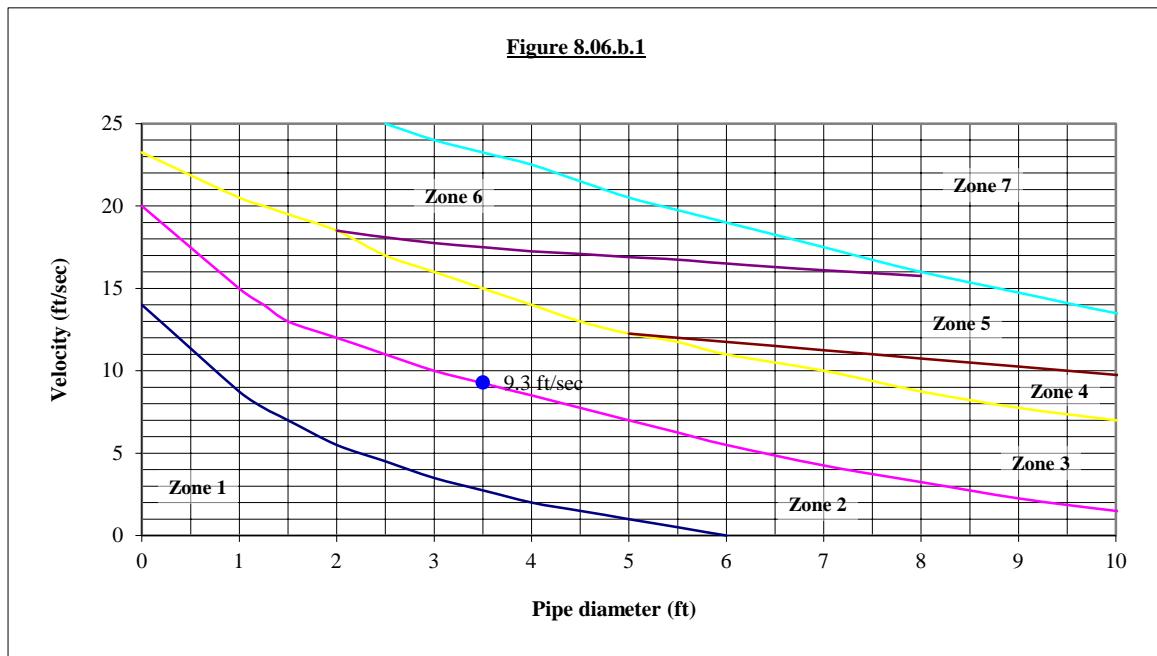
\*Note: Assumes a "square" x-sec (L and W same)

Rebar Calculations ==>

Bar Size	4	5	6	7	8
Diameter (inches)	0.500	0.625	0.750	0.875	1.000
X-Sec Area (SI)	0.196	0.307	0.442	0.601	0.785
Minlimum Number of Bars	30	19	14	10	8

## DESIGN OF RIPRAP OUTLET PROTECTION WORKSHEET

Project	<u>The Point</u>	Date	<u>2/23/2022</u>
Project No.	<u>AWH-20000</u>	Designer	<u>TKD</u>
Outlet ID	<u>SCM H</u>		
Flow, $Q_{10\text{-yr}}$	<u>23.9</u> cfs		
Slope, $S$	<u>1.25</u> %		
Pipe Diameter, $D_o$	<u>42</u> inches		
Pipe Diameter, $D_o$	<u>3.5</u> feet		
Number of pipes	<u>1</u>		
Pipe separation	<u>0</u> feet		
Manning's n	<u>0.013</u>		



Zone from graph above = 3

Outlet pipe diameter	<u>42 in.</u>	Length =	<u>28.0 ft.</u>
Outlet flowrate	<u>23.9 cfs</u>	Width =	<u>10.5 ft.</u>
Outlet velocity	<u>9.3 ft/sec</u>	Stone diameter =	<u>13 in.</u>
Material =	<u>Class I</u>	Thickness =	<u>22 in.</u>

Zone	Material	Diameter	Thickness	Length	Width
1	Class A	3	9	$4 \times D(o)$	$3 \times D(o)$
2	Class B	6	22	$6 \times D(o)$	$3 \times D(o)$
3	Class I	13	22	$8 \times D(o)$	$3 \times D(o)$
4	Class I	13	22	$8 \times D(o)$	$3 \times D(o)$
5	Class II	23	27	$10 \times D(o)$	$3 \times D(o)$
6	Class II	23	27	$10 \times D(o)$	$3 \times D(o)$
7	Special study required				

1. Calculations based on NY DOT method - Pages 8.06.05 through 8.06.06 in NC Erosion Control Manual
2. Outlet velocity based on full-flow velocity



Subsection: Elevation-Area Volume Curve

Label: SCM H

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

Elevation (ft)	Planimeter (ft <sup>2</sup> )	Area (acres)	A1+A2+sqr (A1*A2) (acres)	Volume (ac-ft)	Volume (Total) (ac-ft)
330.00	0.0	0.42	0.00	0.000	0.000
331.00	0.0	0.51	1.40	0.467	0.467
332.00	0.0	0.56	1.61	0.535	1.002
334.00	0.0	0.66	1.82	1.214	2.216
336.00	0.0	0.76	2.12	1.414	3.630



Subsection: Outlet Input Data

Label: SCMH

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

#### Requested Pond Water Surface Elevations

Minimum (Headwater)	330.00 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	336.00 ft

#### Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Rectangular Weir	Copy of Copy of Weir - 1	Forward	Culvert	333.75	334.25
Rectangular Weir	Copy of Weir - 1	Forward	Culvert	333.75	334.25
Rectangular Weir	Weir - 1	Forward	Culvert	333.75	334.25
Orifice-Area	Orifice 1yr	Forward	Culvert	334.25	336.00
Inlet Box	Riser	Forward	Culvert	335.00	336.00
Orifice-Circular	WQOrifice	Forward	Culvert	330.00	336.00
Culvert-Circular	Culvert	Forward	TW	329.50	336.00
Tailwater Settings	Tailwater			(N/A)	(N/A)



Subsection: Outlet Input Data

Label: SCMH

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

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Structure ID: Culvert  
Structure Type: Culvert-Circular

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Number of Barrels	1
Diameter	42.00 in
Length	153.14 ft
Length (Computed Barrel)	153.15 ft
Slope (Computed)	0.010 ft/ft

---

Outlet Control Data

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Manning's n	0.013
Ke	1
Kb	0
Kr	0
Convergence Tolerance	0.00 ft

---

Inlet Control Data

---

Equation Form	Form 1
K	0.0098
M	2.0000
C	0.0398
Y	0.6700
T1 ratio (HW/D)	1
T2 ratio (HW/D)	1
Slope Correction Factor	-1

---

Use unsubmerged inlet 0 equation below T1 elevation.

Use submerged inlet 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,  
interpolate between flows at T1 & T2...

---

T1 Elevation	333.54 ft	T1 Flow	63.0 ft <sup>3</sup> /s
T2 Elevation	334.06 ft	T2 Flow	72.0 ft <sup>3</sup> /s

---



Subsection: Outlet Input Data

Label: SCMH

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

Structure ID:	Riser
Structure Type:	Inlet Box
Number of Openings	1
Elevation	335.00 ft
Orifice Area	36.0 ft <sup>2</sup>
Orifice Coefficient	1
Weir Length	24.00 ft
Weir Coefficient	3.00 (ft <sup>0.5</sup> )/s
K Reverse	1
Manning's n	0
Kev, Charged Riser	0
Weir Submergence	False
Orifice H to crest	False

Structure ID:	WQOrifice
Structure Type:	Orifice-Circular
Number of Openings	1
Elevation	330.00 ft
Orifice Diameter	2.75 in
Orifice Coefficient	1

Structure ID:	Orifice 1yr
Structure Type:	Orifice-Area
Number of Openings	3
Elevation	333.75 ft
Orifice Area	2.5 ft <sup>2</sup>
Top Elevation	334.25 ft
Datum Elevation	334.00 ft
Orifice Coefficient	1

Structure ID:	Weir - 1
Structure Type:	Rectangular Weir
Number of Openings	1
Elevation	333.75 ft
Weir Length	5.00 ft
Weir Coefficient	3.00 (ft <sup>0.5</sup> )/s

Structure ID:	Copy of Weir - 1
Structure Type:	Rectangular Weir
Number of Openings	1
Elevation	333.75 ft
Weir Length	5.00 ft
Weir Coefficient	3.00 (ft <sup>0.5</sup> )/s

Structure ID:	Copy of Copy of Weir - 1
Structure Type:	Rectangular Weir
Number of Openings	1
Elevation	333.75 ft



Subsection: Outlet Input Data

Label: SCMH

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

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Structure ID: Copy of Copy of Weir - 1  
Structure Type: Rectangular Weir

---

Weir Length 5.00 ft  
Weir Coefficient 3.00 (ft<sup>0.5</sup>)/s

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---

Structure ID: TW  
Structure Type: TW Setup, DS Channel

---

Tailwater Type Free Outfall

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Convergence Tolerances

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Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.0 ft <sup>3</sup> /s
Flow Tolerance (Maximum)	10.0 ft <sup>3</sup> /s

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Subsection: Composite Rating Curve

Label: SCMH

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

**Composite Outflow Summary**

Water Surface Elevation (ft)	Flow (ft <sup>3</sup> /s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
330.00	0.0	(N/A)	0.00	(no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser,WQOrifice,Culvert)
330.10	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)
330.20	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)
330.30	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)
330.40	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)
330.50	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)
330.60	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)
330.70	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)
330.80	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)
330.90	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)
331.00	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)
331.10	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)
331.20	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)

Subsection: Composite Rating Curve

Label: SCMH

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

**Composite Outflow Summary**

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
331.30	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)
331.40	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)
331.50	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)
331.60	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)
331.70	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)
331.80	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)
331.90	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)
332.00	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)
332.10	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)
332.20	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)
332.30	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)
332.40	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)
332.50	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)

Subsection: Composite Rating Curve

Label: SCMH

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
332.60	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)
332.70	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)
332.80	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)
332.90	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)
333.00	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)
333.10	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)
333.20	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)
333.30	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)
333.40	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)
333.50	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)
333.60	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)
333.70	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)
333.75	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Orifice 1yr,Riser)

Subsection: Composite Rating Curve

Label: SCMH

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
333.80	0.9	(N/A)	0.00	Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,WQOrifice,Culvert (no Q: Orifice 1yr,Riser)
333.90	3.0	(N/A)	0.00	Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,WQOrifice,Culvert (no Q: Orifice 1yr,Riser)
334.00	6.0	(N/A)	0.00	Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,WQOrifice,Culvert (no Q: Orifice 1yr,Riser)
334.10	9.7	(N/A)	0.00	Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,WQOrifice,Culvert (no Q: Orifice 1yr,Riser)
334.20	13.9	(N/A)	0.00	Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,WQOrifice,Culvert (no Q: Orifice 1yr,Riser)
334.30	20.1	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Riser)
334.40	23.1	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Riser)
334.50	25.8	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Riser)
334.60	28.3	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Riser)
334.70	30.5	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Riser)
334.80	32.6	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Riser)



Subsection: Composite Rating Curve

Label: SCMH

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
334.90	34.6	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Riser)
335.00	36.4	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1,Riser)
335.10	40.4	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1)
335.20	46.3	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1)
335.30	53.3	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1)
335.40	61.2	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1)
335.50	69.7	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1)
335.60	75.3	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1)
335.70	80.3	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1)
335.80	85.1	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1)
335.90	89.7	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1)



Subsection: Composite Rating Curve

Label: SCMH

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

#### Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft <sup>3</sup> /s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
336.00	94.1	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Copy of Copy of Weir - 1,Copy of Weir - 1,Weir - 1)



Subsection: Level Pool Pond Routing Summary

Label: SCM H (IN)

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

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#### Infiltration

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Infiltration Method (Computed)	No Infiltration
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#### Initial Conditions

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Elevation (Water Surface, Initial)	330.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	52.3 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	0.6 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	1,426.00 min

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Elevation (Water Surface, Peak)	333.77 ft
Volume (Peak)	2.068 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	2.422 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.354 ac-ft
Volume (Retained)	2.067 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

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Subsection: Level Pool Pond Routing Summary

Label: SCM H (IN)

Scenario: Post-Dev 10 yr

Return Event: 10 years

Storm Event: 10 yr

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#### Infiltration

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Infiltration Method (Computed)	No Infiltration
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#### Initial Conditions

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Elevation (Water Surface, Initial)	330.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	93.4 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	23.9 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	733.00 min

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Elevation (Water Surface, Peak)	334.43 ft
Volume (Peak)	2.502 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	5.228 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	3.136 ac-ft
Volume (Retained)	2.091 ac-ft
Volume (Unrouted)	-0.002 ac-ft
Error (Mass Balance)	0.0 %

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Subsection: Level Pool Pond Routing Summary  
Label: SCM H (IN)  
Scenario: Post-Dev 25 yr

Return Event: 25 years  
Storm Event: 25 yr

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#### Infiltration

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Infiltration Method (Computed)	No Infiltration
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#### Initial Conditions

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Elevation (Water Surface, Initial)	330.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	107.2 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	36.3 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	730.00 min

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Elevation (Water Surface, Peak)	335.00 ft
Volume (Peak)	2.894 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	6.492 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	4.395 ac-ft
Volume (Retained)	2.095 ac-ft
Volume (Unrouted)	-0.002 ac-ft
Error (Mass Balance)	0.0 %

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Subsection: Level Pool Pond Routing Summary

Label: SCM H (IN)

Scenario: Post-Dev 100 yr

Return Event: 100 years

Storm Event: 100 yr

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#### Infiltration

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Infiltration Method (Computed)	No Infiltration
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#### Initial Conditions

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Elevation (Water Surface, Initial)	330.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	127.2 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	72.4 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	727.00 min

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Elevation (Water Surface, Peak)	335.55 ft
Volume (Peak)	3.293 ac-ft

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#### Mass Balance (ac-ft)

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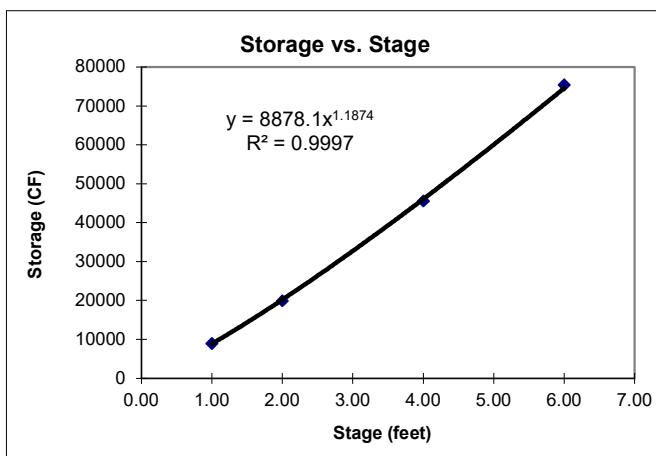
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	8.597 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	6.499 ac-ft
Volume (Retained)	2.096 ac-ft
Volume (Unrouted)	-0.002 ac-ft
Error (Mass Balance)	0.0 %

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*STORMWATER CONTROL MEASURE 'I'*  
*DESIGN CALCULATIONS*

STAGE-STORAGE FUNCTION - ABOVE NORMAL POOL

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
318.00	0.00	7,619				
319.00	1.00	10,306	8963	8963	8963	1.01
320.00	2.00	11,734	11020	11020	19983	1.98
322.00	4.00	13,880	12807	25614	45597	3.97
324.00	6.00	15,964	14922	29844	75441	6.06

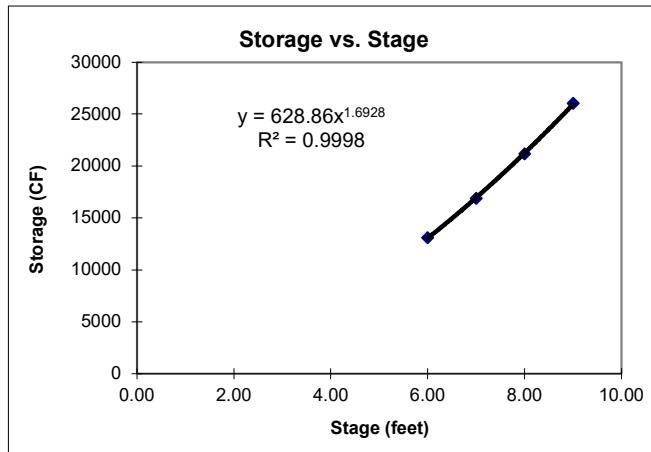


$K_s =$	8878
$b =$	1.1874

**STAGE-STORAGE FUNCTION - MAIN POOL**

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
308.50	-0.50	732				
309.00	0.00	866				
315.00	6.00	3,503	2185	13107	13107	6.01
316.00	7.00	4,029	3766	3766	16873	6.98
317.00	8.00	4,580	4305	4305	21178	7.98
318.00	9.00	5,157	4869	4869	26046	9.02

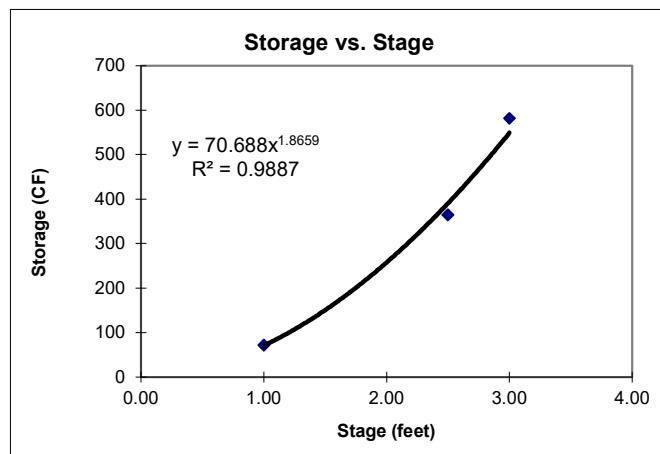
\*surface area and volume used for avg. depth calculation



$K_s =$	629
$b =$	1.6928

**STAGE-STORAGE FUNCTION - FOREBAY**

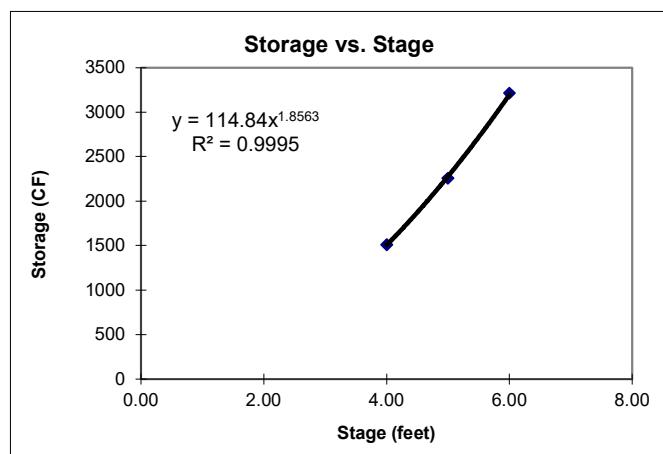
Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
340.50	-0.50	22				
341.00	0.00	42				
342.00	1.00	101	72	72	72	1.01
343.50	2.50	290	196	293	365	2.41
344.00	3.00	577	434	217	582	3.09



$K_s =$	70.7
$b =$	1.8659

**STAGE-STORAGE FUNCTION - FOREBAY**

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
311.50	-0.50	69				
312.00	0.00	109				
316.00	4.00	647	378	1512	1512	4.01
317.00	5.00	844	746	746	2258	4.98
318.00	6.00	1,066	955	955	3213	6.02



$K_s =$	114.8
$b =$	1.8563

**TOTAL VOLUME OF FACILITY**

Volume of Main Pool below Normal Pool= 26,046 cf  
Volume of Forebay below Normal Pool= 3,794 cf  
Total Volume Below Normal Pool = 29,840 cf  
Total Volume Above Normal Pool= 75,441 cf  
Total Volume of Facility = 105,281 cf

**FOREBAY PERCENTAGE OF PERMANENT POOL VOLUME**

*Per NCDEQ Minimum Design Criteria, the forebay volume should equal approximately 15-20% of the main pool volume.*

Total Main Pool Volume = 26,046 cf  
Provided Forebay Volume = 3,794 cf  
Provided Forebay Volume % = 15%

**AVERAGE DEPTH OF MAIN POOL**

Main Pool Volume at Normal Pool = 26,046 cf  
Main Pool Area at Normal Pool = 5,157 sf  
Average Depth = **5.05** ft

**WET DETENTION BASIN SUMMARY**

*Enter the drainage area characteristics ==>*

Total drainage area to pond = 8.37 acres  
Total impervious area to pond = 4.54 acres

Note The basin must be sized to treat all impervious surface runoff draining into the pond, not just the impervious surface from on-site development.

Drainage area = **8.37** acres @ **54.3%** impervious

*Estimate the surface area required at pond normal pool elevation ==>*

Wet Detention Basins are based on an minimum average depth of = **5.05** feet

	5.0	5.05	6.0
Lower Boundary =>	50.0	1.31	1.13
Site % impervious =>	54.3	1.39	1.21
Upper Boundary =>	60.0	1.49	1.31

Therefore, SA/DA required = **1.38**

Surface area required for main pool at normal pool = 5,024 ft<sup>2</sup>  
= 0.12 acres

Surface area provided for total normal pool = 7,619 ft<sup>2</sup>

Surface area estimate for main pool at normal pool = 5,157 ft<sup>2</sup>

**DETERMINATION OF WATER QUALITY VOLUME**

$$WQ_V = (P)(R_V)(A)/12$$

where,

$WQ_V$  = water quality volume (in acre-ft)

$R_V = 0.05 + 0.009(I)$  where I is percent impervious cover

A = area in acres

P = rainfall (in inches)

***Input data:***

Total area, A =	8.37	acres
Impervious area =	4.54	acres
Percent impervious cover, I =	54.3	%
Rainfall, P =	1.00	inches

***Calculated values:***

$$\begin{aligned} R_V &= 0.54 \\ WQ_V &= 0.38 \quad \text{acre-ft} \\ &= 16362 \quad \text{cf.} \end{aligned}$$

**ASSOCIATED DEPTH IN POND**

$$WQ_V = 16362 \quad \text{cf.}$$

***Stage / Storage Data:***

$K_s$ =	8878
b =	1.187
$Z_o$ =	318.00
Volume in 1" rainfall =	16362 cf.

***Calculated values:***

Depth of WQv in Basin =	1.67	ft
=	20.08	inches
Elevation =	319.67	ft

**DRAWDOWN ORIFICE DESIGN**

D orifice =	1.75 inch
# orifices =	1
Ks =	8878
b =	1.1874
C <sub>d</sub> orifice =	0.60
Normal Pool Elevation =	318.00 feet
Volume @ Normal Pool =	0 cf
Orifice Invert =	318.00 feet
WSEL @ 1" Runoff Volume =	319.67 feet

WSEL (feet)	Vol. Stored (cf)	Orifice Flow (cfs)	Avg. Flow (cfs)	Incr. Vol. (cf)	Incr. Time (sec)
319.67	16362	0.102			
319.53	14712	0.097	0.099	1650	16620
319.39	13091	0.092	0.094	1621	17155
319.24	11501	0.087	0.089	1590	17771
319.10	9945	0.081	0.084	1556	18492
318.96	8427	0.076	0.078	1518	19354
318.81	6951	0.069	0.072	1476	20414
318.67	5523	0.062	0.066	1428	21769
318.53	4152	0.054	0.058	1372	23607
318.38	2849	0.045	0.049	1303	26341
318.24	1636	0.033	0.039	1213	31228

Drawdown Time =	2.46 days
-----------------	-----------

By comparison, if calculated by the average head over the orifice  
(assuming average head is one-third the total depth), the result would be:

Average driving head on orifice =	0.534 feet
Orifice composite loss coefficient =	0.600
Cross-sectional area of siphon =	0.017 sf
Q =	0.0587 cfs

Drawdown Time = Volume / Flowrate / 86400 (sec/day)

Drawdown Time =	3.22 days
-----------------	-----------

**RISER ANTI-FLOTATION CALCULATION**

*Input Data ==>*

**Safety Factor:**

Safety factor to use = **1.15** (recommend 1.15 or higher)

**Concrete:**

Concrete unit weight = **142.0** PCF      **Note:** NC Products lists unit wt. of manhole concrete at 142 PCF.

**Riser:**

Inside height of Riser = **6.00** feet  
Inside length of riser = **5.00** feet  
Inside width of riser = **5.00** feet  
Wall thickness of riser = **6.00** inches  
Base thickness of riser = **6.00** inches  
Base length of riser = **6.00** feet  
Base width of riser = **6.00** feet

**Openings:**

Total Orifice Area = **9.017** SF  
OD of barrel exiting manhole = **44.00** inches  
Size of drain pipe (if present) = **6.0** inches

**Trash Rack:**

Bottom Length = **8.40** feet  
Bottom Width = **8.40** feet  
Top Length = **2.10** feet  
Top Width = **2.10** feet  
Height = **2.00** feet  
Trash Rack water displacement = **61.74** CF

*Concrete Present in Riser Structure ==>*

*Total amount of concrete:*

Base of Riser = **18.00** CF  
Riser Walls = **66.00** CF

*Adjust for openings:*

Opening for Orifices = **4.51** CF  
Opening for barrel = **5.28** CF  
Opening for drain pipe = **0.10** CF

Total Concrete present, adjusted for openings = **74.114 CF**  
Weight of concrete present = **10,524 lbs**

***Amount of water displaced by Riser Structure ==>***

Displacement by concrete =	74.11 CF
Displacement by open air in riser =	150.00 CF
Displacement by trash rack =	61.74 CF
Total water displaced by riser/barrel structure =	<b>285.85 CF</b>
Weight of water displaced =	<b>17,837 lbs</b>

***Calculate size of base for riser assembly ==>***

Length =	9.00 feet
Width =	9.00 feet
Thickness =	24 inches
Concrete Present =	162.00 CF

***Check validity of base as designed ==>***

Total Water Displaced =	429.85 CF
Total Concrete Present =	236.11 CF
Total Water Displaced =	26,823 lbs
Total Concrete Present =	33,528 lbs
Actual safety factor =	1.25 <b>OK</b>

***Results of design ==>***

Base length =	9.00 feet
Base width =	9.00 feet
Base Thickness =	24.00 inches
CY of concrete total in base =	6.00 CY
Concrete unit weight in added base >=	142.0 PCF

## II. CALCULATION FOR RISER ANTI-FLOTATION STEEL

Input Data ==>

Anti-Floatation Block Length = 9.0 feet  
Anti-Floatation Block Width = 9.0 feet  
Anti-Floatation Block Thickness = 24 inches

$A_{\text{steel}}$  to  $A_{\text{concrete}}$  Ratio = 0.0020 (recommend 0.0018 or higher)

Cross-Section Calculations==>

Cross-Section Area\* = 18.00 SF  
Minimum Steel Area Required = 0.036 SF  
**5.18** SI

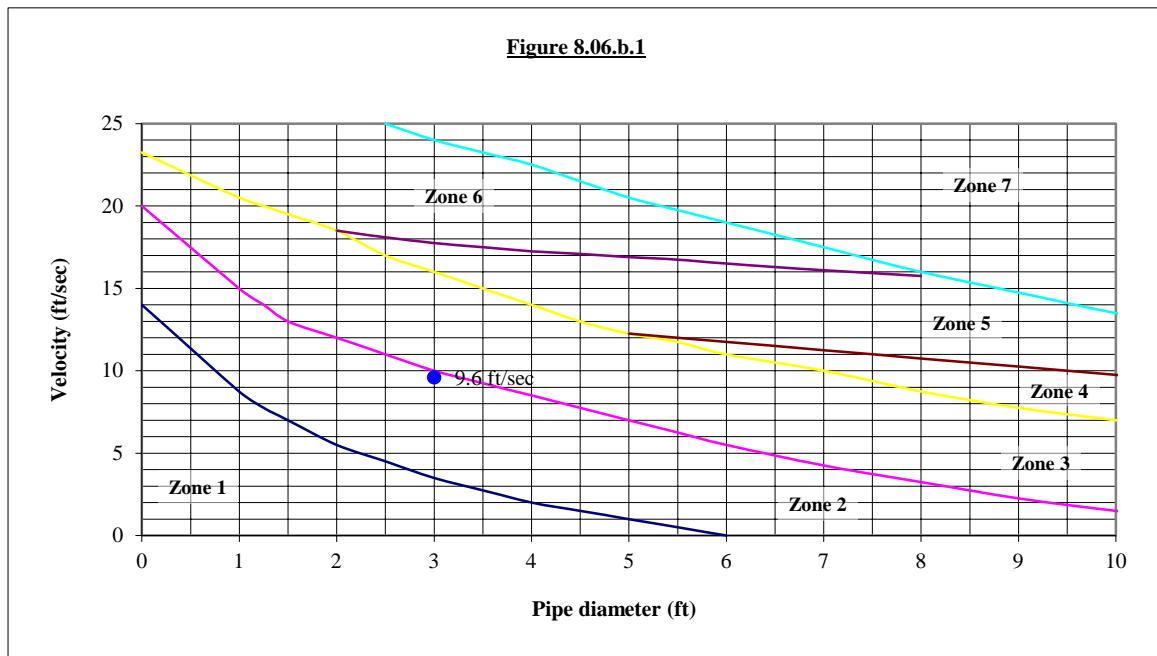
\*Note: Assumes a "square" x-sec (L and W same)

Rebar Calculations ==>

Bar Size	4	5	6	7	8
Diameter (inches)	0.500	0.625	0.750	0.875	1.000
X-Sec Area (SI)	0.196	0.307	0.442	0.601	0.785
Minimum Number of Bars	27	17	12	9	7

## DESIGN OF RIPRAP OUTLET PROTECTION WORKSHEET

Project	<u>The Point</u>	Date	<u>2/23/2022</u>
Project No.	<u>AWH-20000</u>	Designer	<u>TKD</u>
Outlet ID	<u>SCM I</u>		
Flow, $Q_{10\text{-yr}}$	<u>13.6</u> cfs		
Slope, $S$	<u>2.06</u> %		
Pipe Diameter, $D_o$	<u>36</u> inches		
Pipe Diameter, $D_o$	<u>3.0</u> feet		
Number of pipes	<u>1</u>		
Pipe separation	<u>0</u> feet		
Manning's n	<u>0.013</u>		



Zone from graph above = 3

Outlet pipe diameter <u>36 in.</u>	Length = <u>24.0 ft.</u>
Outlet flowrate <u>13.6 cfs</u>	Width = <u>9.0 ft.</u>
Outlet velocity <u>9.6 ft/sec</u>	Stone diameter = <u>13 in.</u>
Material = <u>Class I</u>	Thickness = <u>22 in.</u>

Zone	Material	Diameter	Thickness	Length	Width
1	Class A	3	9	$4 \times D(o)$	$3 \times D(o)$
2	Class B	6	22	$6 \times D(o)$	$3 \times D(o)$
3	Class I	13	22	$8 \times D(o)$	$3 \times D(o)$
4	Class I	13	22	$8 \times D(o)$	$3 \times D(o)$
5	Class II	23	27	$10 \times D(o)$	$3 \times D(o)$
6	Class II	23	27	$10 \times D(o)$	$3 \times D(o)$
7	Special study required				

1. Calculations based on NY DOT method - Pages 8.06.05 through 8.06.06 in NC Erosion Control Manual
2. Outlet velocity based on full-flow velocity



Subsection: Elevation-Area Volume Curve

Label: SCM I

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

Elevation (ft)	Planimeter (ft <sup>2</sup> )	Area (acres)	A1+A2+sqr (A1*A2) (acres)	Volume (ac-ft)	Volume (Total) (ac-ft)
318.00	0.0	0.17	0.00	0.000	0.000
319.00	0.0	0.24	0.61	0.205	0.205
320.00	0.0	0.27	0.76	0.253	0.458
322.00	0.0	0.32	0.88	0.587	1.045
324.00	0.0	0.37	1.03	0.685	1.730



Subsection: Outlet Input Data

Label: SCMI

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

#### Requested Pond Water Surface Elevations

Minimum (Headwater)	318.00 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	324.00 ft

#### Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Orifice-Area	Orifice - 1YR	Forward	Culvert	322.00	324.00
Inlet Box	Riser	Forward	Culvert	323.00	324.00
Orifice-Circular	WQOrifice	Forward	Culvert	318.00	324.00
Culvert-Circular	Culvert	Forward	TW	317.00	324.00
Tailwater Settings	Tailwater			(N/A)	(N/A)



Subsection: Outlet Input Data

Label: SCMI

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

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Structure ID: Culvert  
Structure Type: Culvert-Circular

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Number of Barrels	1
Diameter	36.00 in
Length	48.50 ft
Length (Computed Barrel)	48.51 ft
Slope (Computed)	0.021 ft/ft

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Outlet Control Data

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Manning's n	0.013
Ke	1
Kb	0
Kr	0
Convergence Tolerance	0.00 ft

---

Inlet Control Data

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Equation Form	Form 1
K	0.0098
M	2.0000
C	0.0398
Y	0.6700
T1 ratio (HW/D)	1
T2 ratio (HW/D)	1
Slope Correction Factor	-1

---

Use unsubmerged inlet 0 equation below T1 elevation.

Use submerged inlet 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,  
interpolate between flows at T1 & T2...

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T1 Elevation	320.45 ft	T1 Flow	42.9 ft <sup>3</sup> /s
T2 Elevation	320.89 ft	T2 Flow	49.0 ft <sup>3</sup> /s

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Subsection: Outlet Input Data

Label: SCMI

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

Structure ID: Riser	
Structure Type: Inlet Box	
Number of Openings	1
Elevation	323.00 ft
Orifice Area	25.0 ft <sup>2</sup>
Orifice Coefficient	1
Weir Length	20.00 ft
Weir Coefficient	3.00 (ft <sup>0.5</sup> )/s
K Reverse	1
Manning's n	0
Kev, Charged Riser	0
Weir Submergence	False
Orifice H to crest	False

Structure ID: WQOrifice	
Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	318.00 ft
Orifice Diameter	1.75 in
Orifice Coefficient	1

Structure ID: Orifice - 1YR	
Structure Type: Orifice-Area	
Number of Openings	3
Elevation	322.00 ft
Orifice Area	3.0 ft <sup>2</sup>
Top Elevation	322.75 ft
Datum Elevation	322.38 ft
Orifice Coefficient	1

Structure ID: TW	
Structure Type: TW Setup, DS Channel	

Tailwater Type	Free Outfall
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Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.0 ft <sup>3</sup> /s
Flow Tolerance (Maximum)	10.0 ft <sup>3</sup> /s

Subsection: Composite Rating Curve

Label: SCMI

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
318.00	0.0	(N/A)	0.00	(no Q: Orifice - 1YR,Riser,WQOrifice,Culvert)
318.10	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
318.20	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
318.30	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
318.40	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
318.50	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
318.60	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
318.70	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
318.80	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
318.90	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
319.00	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
319.10	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
319.20	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
319.30	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
319.40	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
319.50	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
319.60	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
319.70	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
319.80	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
319.90	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
320.00	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
320.10	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
320.20	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
320.30	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
320.40	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)



Subsection: Composite Rating Curve

Label: SCMI

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
320.50	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
320.60	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
320.70	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
320.80	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
320.90	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
321.00	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
321.10	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
321.20	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
321.30	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
321.40	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
321.50	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
321.60	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
321.70	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
321.80	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
321.90	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
322.00	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 1YR,Riser)
322.10	3.7	(N/A)	0.00	Orifice - 1YR,WQOrifice,Culvert (no Q: Riser)
322.20	7.2	(N/A)	0.00	Orifice - 1YR,WQOrifice,Culvert (no Q: Riser)
322.30	10.8	(N/A)	0.00	Orifice - 1YR,WQOrifice,Culvert (no Q: Riser)
322.40	14.3	(N/A)	0.00	Orifice - 1YR,WQOrifice,Culvert (no Q: Riser)
322.50	17.8	(N/A)	0.00	Orifice - 1YR,WQOrifice,Culvert (no Q: Riser)
322.60	21.4	(N/A)	0.00	Orifice - 1YR,WQOrifice,Culvert (no Q: Riser)
322.70	24.9	(N/A)	0.00	Orifice - 1YR,WQOrifice,Culvert (no Q: Riser)



Subsection: Composite Rating Curve

Label: SCMI

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
322.80	28.4	(N/A)	0.00	Orifice - 1YR,WQOrifice,Culvert (no Q: Riser)
322.90	31.5	(N/A)	0.00	Orifice - 1YR,WQOrifice,Culvert (no Q: Riser)
323.00	34.4	(N/A)	0.00	Orifice - 1YR,WQOrifice,Culvert (no Q: Riser)
323.10	38.9	(N/A)	0.00	Orifice - 1YR,Riser,WQOrifice,Culvert
323.20	44.8	(N/A)	0.00	Orifice - 1YR,Riser,WQOrifice,Culvert
323.30	51.6	(N/A)	0.00	Orifice - 1YR,Riser,WQOrifice,Culvert
323.40	59.1	(N/A)	0.00	Orifice - 1YR,Riser,WQOrifice,Culvert
323.50	65.9	(N/A)	0.00	Orifice - 1YR,Riser,WQOrifice,Culvert
323.60	68.6	(N/A)	0.00	Orifice - 1YR,Riser,WQOrifice,Culvert
323.70	71.1	(N/A)	0.00	Orifice - 1YR,Riser,WQOrifice,Culvert
323.80	73.6	(N/A)	0.00	Orifice - 1YR,Riser,WQOrifice,Culvert
323.90	75.9	(N/A)	0.00	Orifice - 1YR,Riser,WQOrifice,Culvert
324.00	78.0	(N/A)	0.00	Orifice - 1YR,Riser,WQOrifice,Culvert



Subsection: Level Pool Pond Routing Summary

Label: SCM I (IN)

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

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#### Infiltration

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Infiltration Method (Computed)	No Infiltration
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#### Initial Conditions

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Elevation (Water Surface, Initial)	318.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	24.4 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	0.2 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	1,440.00 min

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Elevation (Water Surface, Peak)	321.78 ft
Volume (Peak)	0.974 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	1.127 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.153 ac-ft
Volume (Retained)	0.974 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.0 %

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Subsection: Level Pool Pond Routing Summary

Label: SCM I (IN)

Scenario: Post-Dev 10 yr

Return Event: 10 years

Storm Event: 10 yr

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#### Infiltration

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Infiltration Method (Computed)	No Infiltration
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#### Initial Conditions

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Elevation (Water Surface, Initial)	318.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	45.5 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	13.6 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	731.00 min

---

Elevation (Water Surface, Peak)	322.38 ft
Volume (Peak)	1.168 ac-ft

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#### Mass Balance (ac-ft)

---

Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	2.525 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	1.476 ac-ft
Volume (Retained)	1.048 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

---



Subsection: Level Pool Pond Routing Summary

Label: SCM I (IN)

Scenario: Post-Dev 25 yr

Return Event: 25 years

Storm Event: 25 yr

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#### Infiltration

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Infiltration Method (Computed)	No Infiltration
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#### Initial Conditions

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Elevation (Water Surface, Initial)	318.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	52.8 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	27.1 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	728.00 min

---

Elevation (Water Surface, Peak)	322.76 ft
Volume (Peak)	1.295 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	3.161 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	2.111 ac-ft
Volume (Retained)	1.049 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

---



Subsection: Level Pool Pond Routing Summary

Label: SCM I (IN)

Scenario: Post-Dev 100 yr

Return Event: 100 years

Storm Event: 100 yr

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#### Infiltration

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Infiltration Method (Computed)	No Infiltration
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#### Initial Conditions

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Elevation (Water Surface, Initial)	318.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	63.2 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	44.4 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	725.00 min

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Elevation (Water Surface, Peak)	323.19 ft
Volume (Peak)	1.442 ac-ft

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#### Mass Balance (ac-ft)

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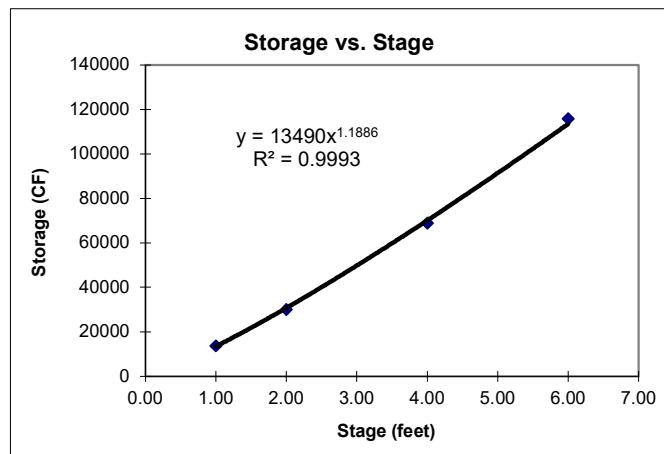
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	4.224 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	3.174 ac-ft
Volume (Retained)	1.049 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

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*STORMWATER CONTROL MEASURE 'J'*  
*DESIGN CALCULATIONS*

STAGE-STORAGE FUNCTION - ABOVE NORMAL POOL

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
310.00	0.00	11,895				
311.00	1.00	15,511	13703	13703	13703	1.01
312.00	2.00	17,403	16457	16457	30160	1.97
314.00	4.00	21,358	19381	38761	68921	3.94
316.00	6.00	25,539	23449	46897	115818	6.10

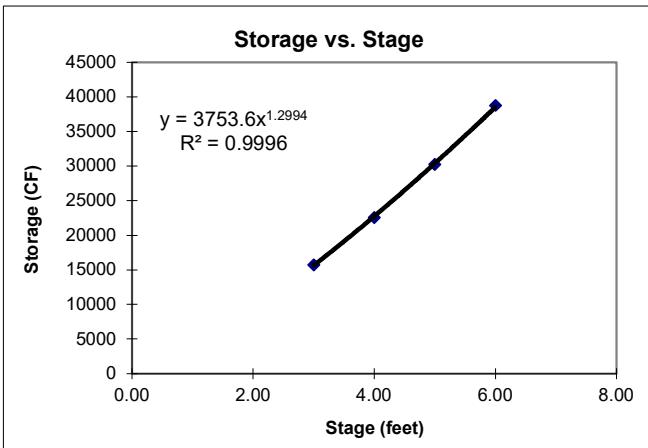


$K_s =$	13490
$b =$	1.1886

**STAGE-STORAGE FUNCTION - MAIN POOL**

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
303.50	-0.50	3,710				
304.00	0.00	4,077				
307.00	3.00	6,414	5246	15737	15737	3.01
308.00	4.00	7,243	6829	6829	22565	3.98
309.00	5.00	8,097	7670	7670	30235	4.98
310.00	6.00	8,977	8537	8537	38772	6.03

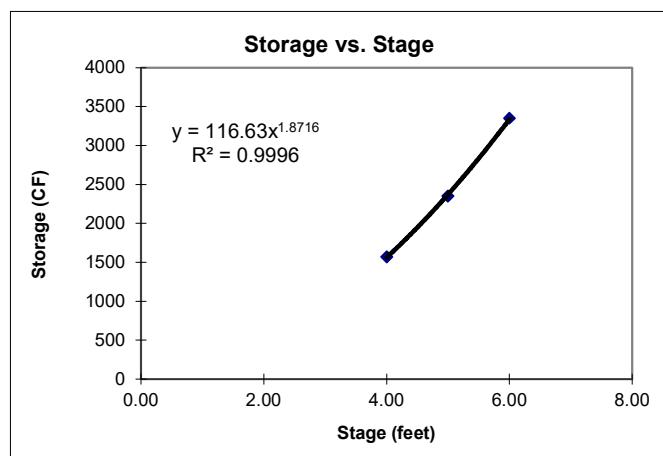
\*surface area and volume used for avg. depth calculation



$K_s =$	3754
$b =$	1.2994

**STAGE-STORAGE FUNCTION - FOREBAY**

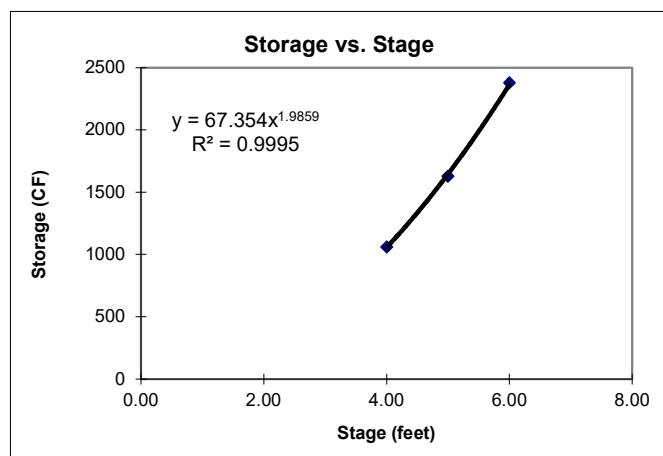
Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
303.50	-0.50	62				
304.00	0.00	105				
308.00	4.00	679	392	1568	1568	4.01
309.00	5.00	886	783	783	2351	4.98
310.00	6.00	1,117	1002	1002	3352	6.02



$K_s =$	116.6
$b =$	1.8716

**STAGE-STORAGE FUNCTION - FOREBAY**

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
304.00	0.00	22				
304.00	0.00	50				Sediment Storage
308.00	4.00	481	266	1062	1062	4.01
309.00	5.00	652	567	567	1629	4.97
310.00	6.00	848	750	750	2379	6.02



$K_s =$	67.4
$b =$	1.9859

**TOTAL VOLUME OF FACILITY**

Volume of Main Pool below Normal Pool= 38,772 cf  
Volume of Forebay below Normal Pool= 5,731 cf  
Total Volume Below Normal Pool = 44,503 cf  
Total Volume Above Normal Pool= 115,818 cf  
Total Volume of Facility = 160,321 cf

**FOREBAY PERCENTAGE OF PERMANENT POOL VOLUME**

*Per NCDEQ Minimum Design Criteria, the forebay volume should equal approximately 15-20% of the main pool volume.*

Total Main Pool Volume = 38,772 cf  
Provided Forebay Volume = 5,731 cf  
Provided Forebay Volume % = 15%

**AVERAGE DEPTH OF MAIN POOL**

Main Pool Volume at Normal Pool = 38,772 cf  
Main Pool Area at Normal Pool = 8,977 sf  
Average Depth = **4.32** ft

**WET DETENTION BASIN SUMMARY**

*Enter the drainage area characteristics ==>*

Total drainage area to pond = 14.19 acres  
Total impervious area to pond = 6.69 acres

Note The basin must be sized to treat all impervious surface runoff draining into the pond, not just the impervious surface from on-site development.

Drainage area = **14.19** acres @ **47.2%** impervious

*Estimate the surface area required at pond normal pool elevation ==>*

Wet Detention Basins are based on an minimum average depth of = **4.32** feet

	4.0	4.32	5.0
Lower Boundary =>	40.0	1.24	1.09
Site % impervious =>	47.2	1.43	<b>1.37</b>
Upper Boundary =>	50.0	1.51	1.31

Therefore, SA/DA required = **1.37**

Surface area required for main pool at normal pool = 8,495 ft<sup>2</sup>  
= 0.20 acres

Surface area provided for total normal pool = 11,895 ft<sup>2</sup>

Surface area provided for main pool at normal pool = 8,977 ft<sup>2</sup>

**DETERMINATION OF WATER QUALITY VOLUME**

$$WQ_V = (P)(R_V)(A)/12$$

where,

$WQ_V$  = water quality volume (in acre-ft)

$R_V = 0.05 + 0.009(I)$  where I is percent impervious cover

A = area in acres

P = rainfall (in inches)

***Input data:***

Total area, A =	14.19	acres
Impervious area =	6.69	acres
Percent impervious cover, I =	47.2	%
Rainfall, P =	1.00	inches

***Calculated values:***

$$\begin{aligned} R_V &= 0.47 \\ WQ_V &= 0.56 \quad \text{acre-ft} \\ &= 24443 \quad \text{cf.} \end{aligned}$$

**ASSOCIATED DEPTH IN POND**

$$WQ_V = 24443 \quad \text{cf.}$$

***Stage / Storage Data:***

$K_s$ =	13490
b =	1.189
$Z_o$ =	310.00
Volume in 1" rainfall =	24443 cf.

***Calculated values:***

Depth of WQv in Basin =	1.65	ft
=	19.79	inches
Elevation =	311.65	ft

**DRAWDOWN ORIFICE DESIGN**

D orifice = **2.25** inch  
 # orifices = **1**  
 Ks = 13490  
 b = 1.1886  
 Cd orifice = **0.60**  
 Normal Pool Elevation = 310.00 feet  
 Volume @ Normal Pool = 0 cf  
 Orifice Invert = 310.00 feet  
 WSEL @ 1" Runoff Volume = 311.65 feet

WSEL (feet)	Vol. Stored (cf)	Orifice Flow (cfs)	Avg. Flow (cfs)	Incr. Vol. (cf)	Incr. Time (sec)
311.65	24443	0.166			
311.51	21977	0.158	0.162	2466	15252
311.37	19554	0.150	0.154	2423	15753
311.23	17178	0.141	0.145	2376	16332
311.08	14853	0.132	0.137	2325	17012
310.94	12585	0.122	0.127	2268	17830
310.80	10380	0.112	0.117	2205	18842
310.66	8247	0.100	0.106	2133	20150
310.52	6199	0.087	0.093	2048	21949
310.38	4254	0.071	0.079	1945	24694
310.24	2444	0.050	0.061	1810	29867

Drawdown Time = 2.29 days

By comparison, if calculated by the average head over the orifice  
(assuming average head is one-third the total depth), the result would be:

Average driving head on orifice = 0.518 feet  
 Orifice composite loss coefficient = **0.600**  
 Cross-sectional area of siphon = 0.028 sf  
 Q = 0.0957 cfs

Drawdown Time = Volume / Flowrate / 86400 (sec/day)

Drawdown Time = 2.96 days

**RISER ANTI-FLOTATION CALCULATION**

*Input Data ==>*

**Safety Factor:**

Safety factor to use = **1.15** (recommend 1.15 or higher)

**Concrete:**

Concrete unit weight = **142.0** PCF      **Note:** NC Products lists unit wt. of manhole concrete at 142 PCF.

**Riser:**

Inside height of Riser = **4.50** feet  
Inside length of riser = **5.00** feet  
Inside width of riser = **5.00** feet  
Wall thickness of riser = **6.00** inches  
Base thickness of riser = **6.00** inches  
Base length of riser = **6.00** feet  
Base width of riser = **6.00** feet

**Openings:**

Total Orifice Area = **2.110** SF  
OD of barrel exiting manhole = **44.00** inches  
Size of drain pipe (if present) = **6.0** inches

**Trash Rack:**

Bottom Length = **8.40** feet  
Bottom Width = **8.40** feet  
Top Length = **2.10** feet  
Top Width = **2.10** feet  
Height = **2.00** feet  
Trash Rack water displacement = **61.74** CF

*Concrete Present in Riser Structure ==>*

*Total amount of concrete:*

Base of Riser = **18.00** CF  
Riser Walls = **49.50** CF

*Adjust for openings:*

Opening for Orifices = **1.06** CF  
Opening for barrel = **5.28** CF  
Opening for drain pipe = **0.10** CF

Total Concrete present, adjusted for openings = **61.067 CF**  
Weight of concrete present = **8,672 lbs**

***Amount of water displaced by Riser Structure ==>***

Displacement by concrete =	61.07 CF
Displacement by open air in riser =	112.50 CF
Displacement by trash rack =	61.74 CF
Total water displaced by riser/barrel structure =	<b>235.31 CF</b>
Weight of water displaced =	<b>14,683 lbs</b>

***Calculate size of base for riser assembly ==>***

Length =	9.00 feet
Width =	9.00 feet
Thickness =	<b>18 inches</b>
Concrete Present =	121.50 CF

***Check validity of base as designed ==>***

Total Water Displaced =	338.81 CF
Total Concrete Present =	182.57 CF
Total Water Displaced =	21,142 lbs
Total Concrete Present =	25,925 lbs
Actual safety factor =	<b>1.23 OK</b>

***Results of design ==>***

Base length =	9.00 feet
Base width =	9.00 feet
Base Thickness =	<b>18.00 inches</b>
CY of concrete total in base =	4.50 CY
Concrete unit weight in added base >=	<b>142.0 PCF</b>

## II. CALCULATION FOR RISER ANTI-FLOTATION STEEL

Input Data ==>

Anti-Floatation Block Length = 9.0 feet  
Anti-Floatation Block Width = 9.0 feet  
Anti-Floatation Block Thickness = 18 inches

A<sub>steel</sub> to A<sub>concrete</sub> Ratio = 0.0020 (recommend 0.0018 or higher)

Cross-Section Calculations==>

Cross-Section Area\* = 13.50 SF  
Minimum Steel Area Required = 0.027 SF  
**3.89** SI

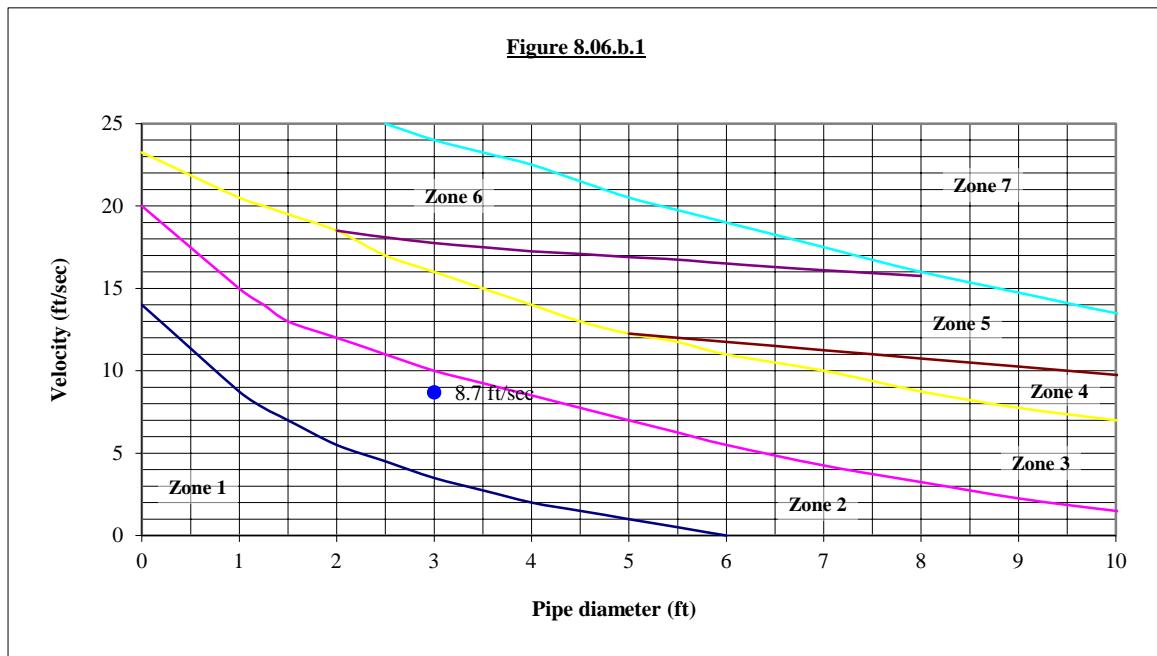
\*Note: Assumes a "square" x-sec (L and W same)

Rebar Calculations ==>

Bar Size	4	5	6	7	8
Diameter (inches)	0.500	0.625	0.750	0.875	1.000
X-Sec Area (SI)	0.196	0.307	0.442	0.601	0.785
Minimum Number of Bars	20	13	9	7	5

## DESIGN OF RIPRAP OUTLET PROTECTION WORKSHEET

Project	<u>The Point</u>	Date	<u>2/23/2022</u>
Project No.	<u>AWH-20000</u>	Designer	<u>TKD</u>
Outlet ID	<u>SCM J</u>		
Flow, $Q_{10\text{-yr}}$	<u>23.1</u> cfs		
Slope, $S$	<u>1.03</u> %		
Pipe Diameter, $D_o$	<u>36</u> inches		
Pipe Diameter, $D_o$	<u>3.0</u> feet		
Number of pipes	<u>1</u>		
Pipe separation	<u>0</u> feet		
Manning's n	<u>0.013</u>		



Zone from graph above = 2

Outlet pipe diameter	<u>36 in.</u>	Length =	<u>18.0 ft.</u>
Outlet flowrate	<u>23.1 cfs</u>	Width =	<u>9.0 ft.</u>
Outlet velocity	<u>8.7 ft/sec</u>	Stone diameter =	<u>6 in.</u>
Material =	<u>Class B</u>	Thickness =	<u>22 in.</u>

Zone	Material	Diameter	Thickness	Length	Width
1	Class A	3	9	$4 \times D(o)$	$3 \times D(o)$
2	Class B	6	22	$6 \times D(o)$	$3 \times D(o)$
3	Class I	13	22	$8 \times D(o)$	$3 \times D(o)$
4	Class I	13	22	$8 \times D(o)$	$3 \times D(o)$
5	Class II	23	27	$10 \times D(o)$	$3 \times D(o)$
6	Class II	23	27	$10 \times D(o)$	$3 \times D(o)$
7	Special study required				

1. Calculations based on NY DOT method - Pages 8.06.05 through 8.06.06 in NC Erosion Control Manual
2. Outlet velocity based on full-flow velocity



Subsection: Elevation-Area Volume Curve

Label: SCM J

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

Elevation (ft)	Planimeter (ft <sup>2</sup> )	Area (acres)	A1+A2+sqr (A1*A2) (acres)	Volume (ac-ft)	Volume (Total) (ac-ft)
310.00	0.0	0.27	0.00	0.000	0.000
311.00	0.0	0.36	0.94	0.314	0.314
312.00	0.0	0.40	1.13	0.378	0.691
314.00	0.0	0.49	1.33	0.888	1.580
316.00	0.0	0.59	1.61	1.075	2.655



Subsection: Outlet Input Data

Label: SCMJ

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

#### Requested Pond Water Surface Elevations

Minimum (Headwater)	310.00 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	316.00 ft

#### Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Rectangular Weir	Weir - 1	Forward	Culvert	313.00	313.50
Orifice-Area	Orifice 1yr	Forward	Culvert	313.50	316.00
Inlet Box	Riser	Forward	Culvert	314.00	316.00
Orifice-Circular	WQOrifice	Forward	Culvert	310.00	316.00
Culvert-Circular	Culvert	Forward	TW	309.50	316.00
Tailwater Settings	Tailwater			(N/A)	(N/A)



Subsection: Outlet Input Data

Label: SCMJ

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

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Structure ID: Culvert  
Structure Type: Culvert-Circular

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Number of Barrels	1
Diameter	36.00 in
Length	50.00 ft
Length (Computed Barrel)	50.00 ft
Slope (Computed)	0.010 ft/ft

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Outlet Control Data

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Manning's n	0.013
Ke	1
Kb	0
Kr	0
Convergence Tolerance	0.00 ft

---

Inlet Control Data

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Equation Form	Form 1
K	0.0098
M	2.0000
C	0.0398
Y	0.6700
T1 ratio (HW/D)	1
T2 ratio (HW/D)	1
Slope Correction Factor	-1

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Use unsubmerged inlet 0 equation below T1 elevation.

Use submerged inlet 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,  
interpolate between flows at T1 & T2...

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T1 Elevation	312.97 ft	T1 Flow	42.9 ft <sup>3</sup> /s
T2 Elevation	313.41 ft	T2 Flow	49.0 ft <sup>3</sup> /s

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Subsection: Outlet Input Data

Label: SCMJ

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

Structure ID: Riser	
Structure Type: Inlet Box	
Number of Openings	1
Elevation	314.00 ft
Orifice Area	25.0 ft <sup>2</sup>
Orifice Coefficient	1
Weir Length	20.00 ft
Weir Coefficient	3.00 (ft <sup>0.5</sup> )/s
K Reverse	1
Manning's n	0
Kev, Charged Riser	0
Weir Submergence	False
Orifice H to crest	False

Structure ID: WQOrifice	
Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	310.00 ft
Orifice Diameter	2.25 in
Orifice Coefficient	1

Structure ID: Orifice 1yr	
Structure Type: Orifice-Area	
Number of Openings	1
Elevation	313.00 ft
Orifice Area	2.0 ft <sup>2</sup>
Top Elevation	313.50 ft
Datum Elevation	313.25 ft
Orifice Coefficient	1

Structure ID: Weir - 1	
Structure Type: Rectangular Weir	
Number of Openings	1
Elevation	313.00 ft
Weir Length	4.00 ft
Weir Coefficient	3.00 (ft <sup>0.5</sup> )/s

Structure ID: TW	
Structure Type: TW Setup, DS Channel	

Tailwater Type	Free Outfall
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Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft



Subsection: Outlet Input Data

Label: SCMJ

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

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Convergence Tolerances

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Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.0 ft <sup>3</sup> /s
Flow Tolerance (Maximum)	10.0 ft <sup>3</sup> /s

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Subsection: Composite Rating Curve

Label: SCMJ

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
310.00	0.0	(N/A)	0.00	(no Q: Weir - 1,Orifice 1yr,Riser,WQOrifice,Culvert)
310.10	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Orifice 1yr,Riser)
310.20	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Orifice 1yr,Riser)
310.30	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Orifice 1yr,Riser)
310.40	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Orifice 1yr,Riser)
310.50	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Orifice 1yr,Riser)
310.60	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Orifice 1yr,Riser)
310.70	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Orifice 1yr,Riser)
310.80	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Orifice 1yr,Riser)
310.90	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Orifice 1yr,Riser)
311.00	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Orifice 1yr,Riser)
311.10	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Orifice 1yr,Riser)
311.20	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Orifice 1yr,Riser)
311.30	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Orifice 1yr,Riser)
311.40	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Orifice 1yr,Riser)
311.50	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Orifice 1yr,Riser)
311.60	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Orifice 1yr,Riser)
311.70	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Orifice 1yr,Riser)
311.80	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Orifice 1yr,Riser)
311.90	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Orifice 1yr,Riser)
312.00	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Orifice 1yr,Riser)
312.10	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Orifice 1yr,Riser)
312.20	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Orifice 1yr,Riser)
312.30	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Orifice 1yr,Riser)
312.40	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Orifice 1yr,Riser)

Subsection: Composite Rating Curve

Label: SCMJ

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

**Composite Outflow Summary**

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
312.50	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Orifice 1yr,Riser)
312.60	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Orifice 1yr,Riser)
312.70	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Orifice 1yr,Riser)
312.80	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Orifice 1yr,Riser)
312.90	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Orifice 1yr,Riser)
313.00	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Orifice 1yr,Riser)
313.10	0.6	(N/A)	0.00	Weir - 1,WQOrifice,Culvert (no Q: Orifice 1yr,Riser)
313.20	1.3	(N/A)	0.00	Weir - 1,WQOrifice,Culvert (no Q: Orifice 1yr,Riser)
313.30	2.2	(N/A)	0.00	Weir - 1,WQOrifice,Culvert (no Q: Orifice 1yr,Riser)
313.40	3.3	(N/A)	0.00	Weir - 1,WQOrifice,Culvert (no Q: Orifice 1yr,Riser)
313.50	5.0	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Weir - 1,Riser)
313.60	5.9	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Weir - 1,Riser)
313.70	6.7	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Weir - 1,Riser)
313.80	7.4	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Weir - 1,Riser)
313.90	8.0	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Weir - 1,Riser)
314.00	8.6	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Weir - 1,Riser)
314.10	11.0	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir - 1)
314.20	15.0	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir - 1)
314.30	19.9	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir - 1)



Subsection: Composite Rating Curve

Label: SCMJ

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
314.40	25.7	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir - 1)
314.50	32.1	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir - 1)
314.60	39.2	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir - 1)
314.70	46.6	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir - 1)
314.80	53.0	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir - 1)
314.90	59.0	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir - 1)
315.00	64.4	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir - 1)
315.10	67.3	(N/A)	0.00	Riser,Culvert (no Q: Weir - 1,Orifice 1yr,WQOrifice)
315.20	68.2	(N/A)	0.00	Riser,Culvert (no Q: Weir - 1,Orifice 1yr,WQOrifice)
315.30	69.1	(N/A)	0.00	Riser,Culvert (no Q: Weir - 1,Orifice 1yr,WQOrifice)
315.40	70.0	(N/A)	0.00	Riser,Culvert (no Q: Weir - 1,Orifice 1yr,WQOrifice)
315.50	70.9	(N/A)	0.00	Riser,Culvert (no Q: Weir - 1,Orifice 1yr,WQOrifice)
315.60	71.8	(N/A)	0.00	Riser,Culvert (no Q: Weir - 1,Orifice 1yr,WQOrifice)
315.70	72.7	(N/A)	0.00	Riser,Culvert (no Q: Weir - 1,Orifice 1yr,WQOrifice)
315.80	73.5	(N/A)	0.00	Riser,Culvert (no Q: Weir - 1,Orifice 1yr,WQOrifice)
315.90	74.4	(N/A)	0.00	Riser,Culvert (no Q: Weir - 1,Orifice 1yr,WQOrifice)
316.00	75.2	(N/A)	0.00	Riser,Culvert (no Q: Weir - 1,Orifice 1yr,WQOrifice)



Subsection: Level Pool Pond Routing Summary

Label: SCM J (IN)

Scenario: Post-Dev 1 yr

Return Event: 1 years

Storm Event: 1 yr

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#### Infiltration

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Infiltration Method (Computed)	No Infiltration
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#### Initial Conditions

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Elevation (Water Surface, Initial)	310.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	37.4 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	1.2 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	902.00 min

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Elevation (Water Surface, Peak)	313.18 ft
Volume (Peak)	1.192 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	1.737 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.599 ac-ft
Volume (Retained)	1.138 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

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Subsection: Level Pool Pond Routing Summary

Label: SCM J (IN)

Scenario: Post-Dev 10 yr

Return Event: 10 years

Storm Event: 10 yr

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#### Infiltration

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Infiltration Method (Computed)	No Infiltration
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#### Initial Conditions

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Elevation (Water Surface, Initial)	310.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	73.4 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	23.1 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	731.00 min

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Elevation (Water Surface, Peak)	314.35 ft
Volume (Peak)	1.756 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	4.043 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	2.864 ac-ft
Volume (Retained)	1.177 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

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Subsection: Level Pool Pond Routing Summary

Label: SCM J (IN)

Scenario: Post-Dev 25 yr

Return Event: 25 years

Storm Event: 25 yr

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#### Infiltration

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Infiltration Method (Computed)	No Infiltration
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#### Initial Conditions

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Elevation (Water Surface, Initial)	310.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	85.9 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	47.9 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	727.00 min

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Elevation (Water Surface, Peak)	314.72 ft
Volume (Peak)	1.945 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	5.104 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	3.917 ac-ft
Volume (Retained)	1.185 ac-ft
Volume (Unrouted)	-0.002 ac-ft
Error (Mass Balance)	0.0 %

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Subsection: Level Pool Pond Routing Summary

Label: SCM J (IN)

Scenario: Post-Dev 100 yr

Return Event: 100 years

Storm Event: 100 yr

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#### Infiltration

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Infiltration Method (Computed)	No Infiltration
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#### Initial Conditions

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Elevation (Water Surface, Initial)	310.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	104.1 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	67.8 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	726.00 min

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Elevation (Water Surface, Peak)	315.16 ft
Volume (Peak)	2.180 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	6.885 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	5.696 ac-ft
Volume (Retained)	1.187 ac-ft
Volume (Unrouted)	-0.002 ac-ft
Error (Mass Balance)	0.0 %

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